

USER'S GUIDE

CONSTRUCTION MASTER® PRO

FOR MODELS:

4060 CONSTRUCTION MASTER® PRO

4030 CONSTRUCTION MASTER® PRO LT

44060 CONSTRUCTION MASTER® PRO DT

44065 CONSTRUCTION MASTER® PRO DT PRINTER

4075 CONSTRUCTION MASTER® PRO TRIG PLUS III™



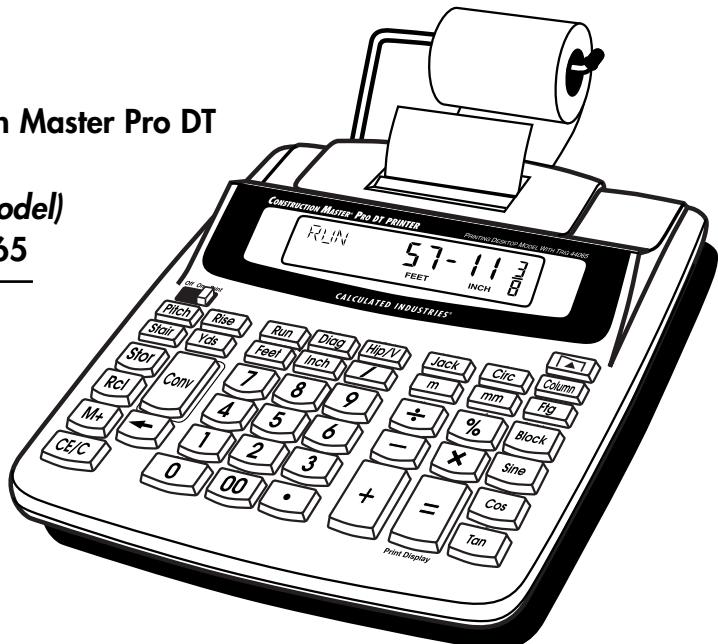
CALCULATED INDUSTRIES®

Putting answers at your fingertips since 1978



Construction Master Pro Model 4060

Construction Master Pro DT Printer (Desktop model) Model 44065



CONSTRUCTION MASTER® PRO

USER'S GUIDE

This User's Guide helps you solve common construction math and material estimation problems using the latest *Construction Master® Pro* calculators—five of the most powerful feet-inch-fraction calculators to date:

The ***Construction Master Pro* Series** —

1. **LT (#4030)**
2. **Handheld (#4060)**
3. **Trig Plus III (#4075)**
4. **Desktop (#44060)**
5. **New! Desktop with Printer (#44065)***

*CI now offers a *Printing Model*—the *Construction Master Pro DT Printer*! It has all the features of the *Construction Master Pro Desktop*, plus a built-in **printer** (see **Appendix C**).

IMPORTANT: The *Construction Master Pro* calculators share many keys and functions. However, some keys and functions differ. Please refer to the grid on **page 8** to see what features are applicable to your model, so that you can follow the corresponding examples in this User's Guide. **Note:** the Desktop with Printer (#44065) operates almost identically to the Desktop (#44060).

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INTRODUCTION

The *Construction Master Pro* line includes the most advanced feet-inch-fraction calculators *designed specifically for building pro's!*

The *Pro* calculators handle practically any problem involving measurements and can be used to save time, prevent errors, and accurately perform common building projects such as: estimating concrete volume, squaring up foundations, framing roofs, ordering lumber, building stairs, walls, laying driveways, carpet or floor covering, figuring precise angle calculations, or simply working in feet-inch-fractions or decimal feet!

Your Calculator Helps You Solve:

- Dimensional Math Problems
- Conversions Between Feet-Inch-Fractions, Decimal Feet, Decimal Inch and Yards
- English/Metric Conversions
- Problems Involving All Common Fractions – $1/2"$ to $1/64"$!
- Area/Volume Calculations
- Board Feet/Lumber Calculations
- Circle Calculations
- Material Estimations and Costs
- Rake Walls
- Right Angle/Triangle Solutions
- Stair Layout (Risers/Treads)
- Weight/Volume Conversions

Selected Models Also Solve:

- Block/Brick, Concrete Footing, Column and Roof Bundle Material Estimation
- Complete Rafter Solutions (Regular and Irregular Hip/Valley Rafters, Jack Rafters and Cut Angles)
- Trigonometry Calculations

CONSTRUCTION MASTER® PRO — KEY/FUNCTION COMPARISON

The *Construction Master Pro* calculators vary slightly in keys and functions, sharing basic measurement unit, right triangle and stair keys. Some models additionally compute advanced roof framing problems, project material estimations, or advanced Trigonometry applications.

Note: The *DT (Desktop) with Printer* (#44065) operates almost identically to the *DT* (#44060).

AVAILABLE KEYS OR FUNCTIONS	LT (#4030)	Hand- held (#4060)	DT (#44060)	Trig Plus III (#4075)
Works in All Fractions (1/2"-1/64")	•	•	•	•
Dimensional Unit Keys and Conversions (Feet, Inches, Fractions, Yards, Metric, Acres)	•	•	•	•
Weight Keys and Conversions (lbs, kg, tons, Metric tons)	•	•	•	•
Block/Brick		•	•	
Board Feet	•	•	•	•
Circle	•	•	•	•
Column		•	•	•
\$Cost	•	•	•	•
D:M:S	•	•	•	•
Footing	•	•	•	
Pitch, Rise, Run, Diag.	•	•	•	•
Rake Wall	•	•	•	•
Roof Framing Keys (Reg. and Irreg. Hip/ Valley, Jacks, Cuts)		•	•	•
Roof Area and Bundles		•	•	
Stair	•	•	•	•
Trigonometric Keys			•	•
Preference Settings	•	•	•	•

KEY DEFINITIONS

BASIC OPERATION KEYS

[On/C] — On/Clear

Turns power on. Pressing once clears the display. Pressing twice clears all temporary values.

[Off]

Turns all power off, clearing all non-permanent registers.

[+] [-] [x] [÷] [=]

Arithmetic operation keys.

[%]

Four-function percent key.

[0] – [9] and [.]

Digits used for keying in numbers.

[00] (Desktop Only)

Enters “00” to save keystrokes (e.g., 1 [00] to enter 100).

[v] — Backspace Key

Used to delete entries one keystroke at a time (unlike the **[On/C]** function, which deletes the entire entry).

Convert [Conv] Key—Unit Conversions and Second Functions

The **[Conv]** key is to convert between measurement units or to access second functions, listed below:

[Conv] — Convert

Used with the measurement keys to convert between units or with other keys to access special functions.

[Conv] [x] — All Clear

Clears all values, including Memory. Resets all permanent settings to defaults.

 **Note:** Use only when necessary, as it deletes all stored values.

[Conv] [%] — x^2

Squares the value in the display. For example, to square the value 10, enter 10 then **[Conv] [%]**.

[Conv] [u] — Square Root Function ($\sqrt{ }$)

Used to find the square root of a non-dimensional or area value (e.g., 100 **[Conv] [u]** = 10).

[Conv] [/] — $x10^x$

Allows entry of an exponent. For example, 8 **[Conv] [/]** 14 is 8 times 10 to the 14th power.

[Conv] [÷] — $1/x$

Finds the reciprocal of a number (e.g., 8 **[Conv] [÷]** = 0.125).

[Conv] [-] — Change (+ / -) Sign

Toggles the sign of the displayed value to plus or minus.

[Conv] [+] — Pi (p)

Constant = 3.141593

[Conv] [.] — Degrees: Minutes: Seconds

Converts between D:M:S and decimal degree formats.

[Conv] [9] — Total Cost

Computes total material cost given a unit dimension and an entered *Per Unit Cost*.

[Conv] [Stor] — Access Preference Settings

Used to access various customizable settings, such as dimensional answer formats (see *Preference Settings on page 96*).

Memory and Storage Functions

Your calculator has two types of Memory:

- 1) basic memory or semi-permanent, cumulative **[M+]**;
- 2) non-cumulative Storage Registers (M1) and (M2).

[M+] — Semi-Permanent Memory

Adds any displayed number, dimensioned or unitless, to the semi-permanent, accumulating Memory. Values can be subtracted from this Memory using **[Conv] [M+]**. **[Rcl] [Rcl]** will recall and clear the Memory. **[Conv] [Rcl]** will clear the accumulating Memory without disturbing the existing display.

[Stor] [1] — Storage Register (M1)

Stores the displayed value in non-cumulative, permanent Memory (e.g., 10 **[Stor] [1]**, **[Rcl] [1]** = 10). Good for storing a single value, for future reference.

Note: *Non-cumulative means it only accepts one value (does not add or subtract) and a second entered value will replace the first. Permanent means the value is stored even after the calculator is shut off. To delete a stored value, enter a new value or perform an All Clear [Conv] [x].*

[Stor] [2] — Storage Register (M2)

Same function as **[Stor] [1]**. See above.

Recall [Rcl] Key

The **[Rcl]** key is used to recall or review stored values (e.g., **[Rcl]** **[Pitch]** to recall a previously entered pitch value). It is also used in reviewing stored settings, or in Paperless Tape and Memory operation (see below).

[Rcl] [=] — Paperless Tape

Accesses the paperless tape mode (see “*Paperless Tape*,” page 36), which keeps track of your past 20 entries. Useful for checking strings of numbers.

[Rcl] [Rcl] — Clear M+

Displays and clears M+.

[Rcl] [M+] — Recall M+

Displays value stored in M+.

[Rcl] [1] —Recall M1

Recalls the stored value in M1.

[Rcl] [2] —Recall M2

Recalls the stored value in M2.

DIMENSIONAL MEASUREMENT UNIT KEYS

The following keys are used for entering units of measure, with ease and accuracy:

[Yds] — Yards

Enters or converts to *yards*.

[Feet]

Enters or converts to *feet*. Also used with the **[Inch]** and **[/]** keys for entering feet-inch values (e.g., 6 **[Feet]** 9 **[Inch]** 1 **[/]** 2). **Note:** Repeated presses after **[Conv]** toggle between feet-inches and decimal feet (e.g., 6 **[Feet]** 9 **[Inch]** 1 **[/]** 2 **[Convert]** **[Feet]** = 6.791667 feet; press **[Feet]** again to return to feet-inch-fractions).

[Inch]

Enters or converts to *inches*. Also used with the **[/]** key for entering fractional inch values (e.g., 9 **[Inch]** 1 **[/]** 2). **Note:** Repeated presses after **[Conv]** toggle between fractional and decimal inches (e.g., 9 **[Inch]** 1 **[/]** 2 **[Convert]** **[Inch]** = 9.5 inch; press **[Inch]** again to return to inch-fractions).

[/] — Fraction Bar

Used to enter fractions. Fractions may be entered as proper (1/2, 1/8, 1/16) or improper (3/2, 9/8). If the denominator (bottom) is not entered, the calculator's fractional resolution setting is automatically used (e.g., entering 15 **[/]** **[=]** or **[+]** will display 15/16, based on the default fractional resolution setting of 16ths (default setting for Trig Plus III is 64ths).

[m] — Meters

Enters or converts to *meters*.

[Conv] [5] — Centimeters

Enters or converts to *centimeters*.

[mm] — Millimeters

Enters or converts to *millimeters*.

[Conv] [2] — Acres

Enters or converts (a square value) to acres.

[Conv] [0] — Board Feet

Enters or converts cubic values to board feet. One board foot is equal to 144 cubic inches.

WEIGHT KEYS

[Conv] [1] — Kilograms

Enters or converts (a weight or volume value) to kilograms. A dimensioned volume will convert using the stored weight per volume value.

[Conv] [3] — Metric Tons

Enters or converts (a weight or volume value) to Metric tons. A dimensioned volume will convert using the stored weight per volume value.

[Conv] [4] — Pounds (lbs)

Enters or converts (a weight or volume value) to pounds. A dimensioned volume will convert using the stored weight per volume value.

[Conv] [6] — Tons

Enters or converts (a weight or volume value) to tons. A dimensioned volume will convert using the stored weight per volume value.

[Conv] [8] — Store Weight per Volume

Stores a new weight per volume value as tons per cubic yard (*default = 1.5 tons per cubic yard*), or other format, as listed below:

Note: After entering a value and pressing **[Conv] [8]**, continue pressing the **[8]** digit key until you've reached the desired weight per volume format. To recall your setting, press **[Rcl] [8]**.

- Ton Per CU YD
- LB Per CU YD
- LB Per CU FEET
- Ton Per CU M
- kG Per CU M

Construction Project Keys

The following Construction Project Keys help you instantly figure quantities and costs of materials, so you can build like a pro!

Block/Brick Key

The Block key helps you quickly estimate the quantity of blocks or bricks required for building walls, walkways or other areas.

[Block] — Number of Blocks or Bricks

Calculates the total number of concrete blocks required to fill a given area. *Uses a standard block/mortar area of 128 square inches.* This key can also be used for calculating the number of “face” or “paver” bricks by storing a brick size (see below).

[Stor] [Block] — Store Block or Brick Size

Used to store a size *other than the default block size of 128 square inches* (e.g., 120 **[Stor] [Block]** stores a size of 120 square inches). This value is permanently stored until you change it or perform an All Clear. To recall the stored setting, press **[Rcl] [Block]**.

Note: For Brick Estimates—You may also enter a brick size using **[Stor] [Block]**. For example, when building with standard “face” bricks, enter a brick size of 21 square inches (21 **[Stor] [Block]**) or store a “paver” brick size of 32 square inches (32 **[Stor] [Block]**); based on Modular U.S. brick size of 3-5/8 inches x 2-1/4 inches x 7-5/8 inches, including 3/8 inch mortar = 4 inches x 2-5/8 inches x 8 inches).

Circular Function Keys

The circle key helps you quickly solve circular area, volume or arc problems.

[Circ] — Circle

Displays and calculates the following values, given an entered circle diameter* or radius:

- diameter
- circle area
- circumference

*To enter a diameter (e.g., 10 feet), press 10 [Feet] [Circ].

[Conv] [Diag] — Radius

Enters or calculates the circle radius (e.g., 5 [Feet] [Conv] [Diag]).

[Conv] [Circ] — Arc Length or Degree of Arc

Enters or calculates arc length or degree of arc, and further solves for additional circular values, listed below.

If a circle diameter and arc degree (or arc length) are entered, further presses of **[Circ]** will display and calculate the following:

- arc length or degree of arc
- chord length
- segment rise
- pie slice area
- segment area (between the chord and the arc)

[Run] — Run (Chord Length)

Used with **[Rise]** or **[Conv] [Diag]** to find the chord length or the radius of a circular segment. If the segment rise and radius have been entered, this key will display the chord length of the circular segment.

[Rise] — Rise (Segment Rise)

Used with **[Run]** or **[Conv]** **[Diag]** to find the rise or the radius of a circular segment. If the chord length and radius have been entered, this key will display the segment rise of the circular segment.

Column/Cone Key

The Column and Cone functions help you quickly estimate volume and surface area of columns or cones.

[Column]

Calculates the total volume and surface area of a column using the values stored in **[Circ]** and **[Rise]**.

[Conv] [Column] — Cone

Calculates the total volume and surface area of a cone using the values stored in **[Circ]** and **[Rise]**.

Footing Key

The Footing key helps you quickly estimate the volume of concrete required for concrete footings.

[Ftg] — Footing

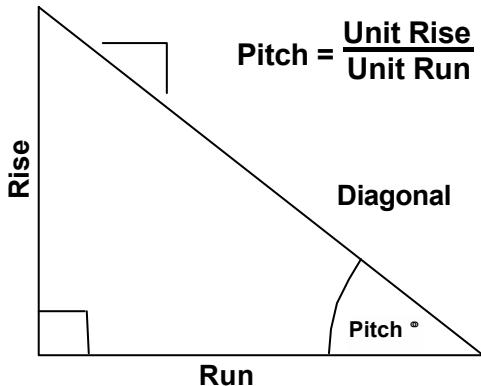
Calculates total quantity of concrete required based on a given wall length and footing size. *Size based on standard or default footing size equal to 1.8 square feet or 259.2 square inches.*

[Stor] [Ftg] — Store Footing Area

Used to store a *value other than the default of 1.8 square foot footing size* (e.g., 128 **[Stor]** **[Ftg]** stores a footing size of 128 square inches). This value is permanently stored until you change it or perform an All Clear. To recall the stored setting, press **[Rcl]** **[Ftg]**.

Right Triangle/Roof Framing Keys

Right Triangle:



Using the Pythagorean theorem, the top row of keys on your *Construction Master Pro* provide instant solutions in dimensional format to right triangle problems (particularly, roof framing).

The *Construction Master Pro*'s keys are labeled in easy to remember roofing terms. The right triangle is calculated simply by entering two of four variables: 1) Rise, 2) Run, 3) Diagonal or 4) Pitch.

[Pitch]

Enters or calculates the pitch (slope) of a roof (or right triangle).

Pitch is the amount of "rise" over 12 inches (or 1 meter) of "run."

Pitch may be entered as:

- a dimension: 9 [Inch] [Pitch]
- an angle: 30 [Pitch]
- a ratio: 0.75 [Conv] [Pitch]
- a percentage: 75 [%] [Pitch]

Note: An entered (vs. calculated) pitch is a **permanent** entry. This means that it will remain stored even after you turn the calculator off. To change the pitch, simply enter a new pitch value.

*In contrast, a **calculated** pitch value is **not permanently stored**. This means that the calculator will return to the pitch value you **last entered** when you clear the calculator or press [On/C] twice.*

[Rise]

Enters or calculates the rise or vertical leg (height) of a right triangle.

[Run]

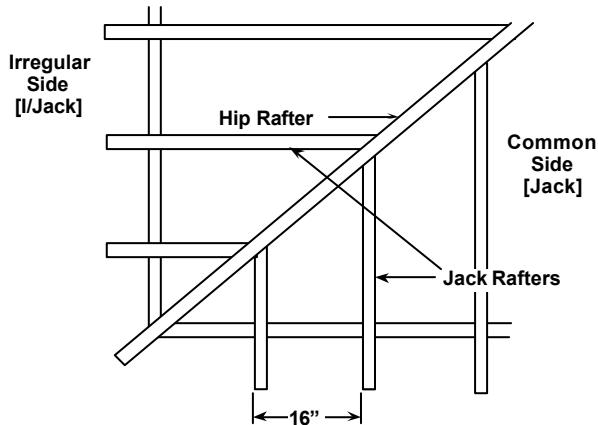
Enters or calculates the run or horizontal leg (base) of a right triangle.

[Diag] — Diagonal

Enters or calculates the diagonal leg (hypotenuse) of a right triangle. Typical applications are “squaring up” slabs or finding Common rafter lengths. Additional presses of the **[Diag]** key will also display Plumb and Level cut angles in degrees.

Note: The Common rafter calculation is the “point-to-point” length and does not include the overhang or ridge adjustment.

Hip/Valley and Jack Rafter Keys



The *Construction Master Pro* uses the rise, run, diagonal, pitch and o.c. spacing values to compute *regular* (45°) and *irregular* (non- 45°) Hip/Valley and Jack rafter lengths (*excluding wood thickness, etc.*).

When calculating regular and irregular Jack rafter lengths, you will see the letters "JK" (Common pitch side) or "IJ" (irregular pitch side) and the corresponding Jack number to the left of your calculator display. This will help you keep track of the descending sizes and which side the corresponding rafter is based on.

[Hip/V] — Hip/Valley Rafter

Finds the regular (45°) or irregular (non- 45°) Hip/Valley rafter length.

- **Regular Hip/Valley Length:** After right triangle/rafter values are entered or calculated (e.g., pitch, rise, run), pressing **[Hip/V]** will calculate the length of the *regular* Hip/Valley rafter.
- **Irregular Hip/Valley Length:** If an irregular pitch is entered via **[Conv]** **[Hip/V]** (see next page), pressing **[Hip/V]** will calculate the *irregular* Hip/Valley rafter length. (An irregular or "non-standard" roof has two different pitches/slopes.)

- Subsequent presses of the **[Hip/V]** key will also display Plumb, Level, and Cheek cut angle values in degrees.

[Conv] [Hip/V] — Irregular Pitch

Enters the *irregular* or secondary pitch value used to calculate lengths of the irregular Hip/Valley and Jack rafters.

You may enter the irregular pitch as:

- a dimension: 9 **[Inch] [Conv] [Hip/V]**
- an angle: 30 **[Conv] [Hip/V]**
- a percentage: 75 **[%] [Conv] [Hip/V]**

Note: An entered irregular pitch can be recalled by pressing **[Rcl] [Conv] [Hip/V]**.

[Jack] — Jack Rafters

Finds the descending Jack rafter sizes for *regular* pitched roofs, based on the stored on-center spacing and previously entered or calculated right triangle/rafter values (e.g., pitch, rise, run).

- The default on-center spacing is 16 inches. A new on-center spacing may be entered and permanently stored by pressing an inch value and **[Stor] [7]** (e.g., 12 **[Inch] [Stor] [7]**). The current on-center spacing value can be viewed by pressing **[Rcl] [7]**.
- Repeated presses of the **[Jack]** key will display all the rafter sizes (on the *regular* pitch side) as well as display the Plumb, Level, and Cheek cut angle values. Additional presses will display the rafter sizes on the *irregular* pitch side (if an irregular pitch was entered; see above), or repeat the previously displayed values.

Note: You may set your calculator to display the Jack rafter lengths in either ascending or descending order (see *Preference Settings* on page 96).

Note: You may program your calculator to “mate up” the Jack rafters, rather than using the entered or default on center for both sides (see *Preference Settings* on page 96).

[Conv] [Jack] — Irregular Side Jacks

Operates same as **[Jack]**, but displays the rafter values from the *irregular* pitched side first.

Rake Wall Function

[Conv] [Rise] — Rake Wall

This function finds the stud sizes in a Rake Wall given computed or entered values for pitch, rise and/or run. The various sizes will be displayed via repeated presses of **[Rise]**. The sizes can be displayed in either descending (from longest to shortest) or ascending (from shortest to the longest) order, depending upon your preference setting (see *Preference Settings* on page 96). If a value is entered prior to pressing **[Conv] [Rise]**, this value will be taken as the Base size and automatically added to the various rafter lengths.

[Stor] [7] — Store On-Center (o.c.) Spacing

Used to store a value other than the default of 16 inches on center (e.g., 18 **[Inch] [Stor] [7]** stores an 18 inch on center) for Rake Wall stud calculations. Press **[Rcl] [7]** to review the stored value.

Roof Key

The *Construction Master Pro*'s Roof function provides a quick computation of roof area, given a floor area and a roof pitch. In addition, this function also converts the calculated Roof Area into a quantity of (33-1/3 square feet) bundles of shingles.

[Roof]

Converts an entered floor area into a roof area. A second press will display the quantity of (33-1/3 square feet) bundles of shingles required to cover the computed roof area.

[Conv] [00] — Roof (*Desktop Only*)

Same as above. A second press of **[00]** will display the quantity of (33-1/3 square feet) bundles of shingles required to cover the computed roof area.

Stair Key

The *Construction Master Pro* easily computes stair layout solutions. Given values for rise and/or run, your calculator will compute riser, tread, stringer and angle of incline values simply by pressing the **[Stair]** key.

[Stair]

A multi-function key that uses a stored desired riser height, desired tread width, and rise and run values to compute and display the following:

Press	Result
1	Riser Size
2	Number of Risers
3	Riser Overage/Underage
4	Tread Width
5	Number of Treads
6	Tread Overage/Underage
7	Stringer Length
8	Angle of Incline

Note: Default values are 7-1/2 inches for Desired Riser Height and 10 inches for Desired Tread Width.

Note: It is not possible for the calculator to include the nose/overhang measurement. Thus, you need to adjust for this measurement per local codes.

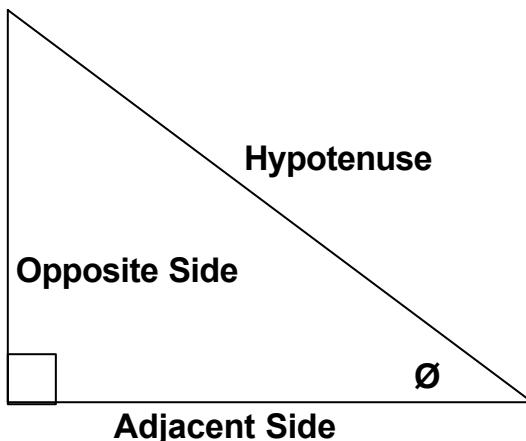
[Stor] [Stair] — Store Desired Riser Height

Stores a value *other than the default desired stair riser height of 7-1/2 inches* (e.g., 8 [**Inch**] **[Stor]** **[Stair]** stores an 8-inch desired stair riser height). To recall the stored setting, press **[Rcl]** **[Stair]**.

[Stor] [m**] — Store Desired Tread Width**

Stores a value *other than the default desired stair tread width of 10 inches* (e.g., 12 [**Inch**] **[Stor]** [**m**] stores a 12-inch desired stair tread width). This value is used when the run or the rise has not been entered (*used as the tread width when a run has not been entered and with the run value to solve the stair parameters when a rise has not been entered.*) To recall the stored setting, press **[Rcl]** [**m**].

TRIGONOMETRY FUNCTION KEYS



$$\text{Tangent } \theta = \frac{\text{Opposite}}{\text{Adjacent}}$$

$$\text{Sine } \theta = \frac{\text{Opposite}}{\text{Hypotenuse}}$$

$$\text{Cosine } \theta = \frac{\text{Adjacent}}{\text{Hypotenuse}}$$

The *Desktop* and *Trig Plus III* calculators have standard trigonometric keys, in addition to Right Triangle/Rafter keys (e.g., Rise, Run, Diagonal), for advanced right triangle mathematics.

The sine, cosine and tangent of an angle are defined in relation to the sides of a right triangle.

Using the **[Conv]** key with the trigonometric function gives you the arcsine, arccosine and arctangent – all of which are used to find the angle for the sine, cosine, or tangent value entered.

[Sine] — Sine Function

Computes the sine of a degree or undimensioned* value.

[Conv] [Sine] — Arcsine (\sin^{-1})

Computes the angle for the entered or calculated sine value.

[Cos] — Cosine Function

Computes the cosine of a degree or undimensioned value.

[Conv] [Cos] — Arccosine (\cos^{-1})

Computes the angle for the entered or calculated cosine value.

[Tan] — Tangent Function

Computes the tangent of a degree or undimensioned value.

[Conv] [Tan] — Arctangent (\tan^{-1})

Computes the angle for the entered or calculated tangent value.

 ***Note:** Cannot use on dimensioned values.

GETTING STARTED

ENTERING DIMENSIONS

Entering Linear Dimensions

When entering feet-inch-fraction values, enter dimensions from largest to smallest — *e.g., feet before inches, inches before fractions*. Enter fractions by entering the numerator (top), pressing **[/]** (fraction bar key) and then the denominator (bottom).

 **Note:** If a denominator is not entered, the fractional setting value is used.

Examples:

<u>Dimension</u>	<u>Keystrokes</u>
5 Yards	5 [Yds]
5 Feet 1-1/2 Inch	5 [Feet] 1 [Inch] 1 [/] 2
17.5 Meters	17.5 [m]

Entering Square/Cubic Dimensions

The *Construction Master Pro* lets you easily enter square and cubic values. Simply press a dimensional unit key *two* times to label a number as a square value, or *three* times to label a cubic value. (*Note: If you pass the desired dimensional format, keep on pressing the dimensional unit key until the desired result is displayed.*) Enter square and cubic dimensions in the following order:

- (1) Enter numerical value (e.g., 100).**
- (2) Press desired unit key (e.g., [Feet]) to label value as “linear.”**
- (3) Second press of unit key (e.g., [Feet]) labels value as “square.”**
- (4) Third press of unit key labels value as “cubic.”**

 **Note:** Feet-Inch format cannot be used to enter square or cubic values.

Examples of Square and Cubic Entry:

[Yds] [Yds] — Square Yards

(e.g., 5 [Yds] [Yds] will display 5. SQ YD).

[Yds] [Yds] [Yds] — Cubic Yards

(e.g., 5 [Yds] [Yds] [Yds] will display 5. CU YD).

[Feet] [Feet] — Square Feet

(e.g., 5 [Feet] [Feet] will display 5. SQ FEET).

[Feet] [Feet] [Feet] — Cubic Feet

(e.g., 5 [Feet] [Feet] [Feet] will display 5. CU FEET).

[Inch] [Inch] — Square Inches

(e.g., 5 [Inch] [Inch] will display 5. SQ INCH).

[Inch] [Inch] [Inch] — Cubic Inches

(e.g., 5 [Inch] [Inch] [Inch] will display 5. CU INCH).

[m] [m] — Square Meters

(e.g., 5 [m] [m] will display 5. SQ M).

[m] [m] [m] — Cubic Meters

(e.g., 5 [m] [m] [m] will display 5. CU M).

[mm] [mm] — Square Millimeters

(e.g., 5 [mm] [mm] will display 5. SQ MM).

[mm] [mm] [mm] — Cubic Millimeters

(e.g., 5 [mm] [mm] [mm] will display 5. CU MM).

[Conv] [5] [5] — Square Centimeters

(e.g., 5 [Conv] [5] [5] will display 5. SQ CM).

[Conv] [5] [5] [5] — Cubic Centimeters

(e.g., 5 [Conv] [5] [5] [5] will display 5. CU CM).

CONVERSIONS (LINEAR, AREA, VOLUME)

Linear Conversions

Convert 14 feet to other dimensions:

<u>Keystroke</u>	<u>Display</u>
[On/C] [On/C]	0.
14 [Feet] [Conv] [Yds]	4.666667 YD
[Feet]	14 FEET 0 INCH
[Inch]	168 INCH
[m]	4.267 M
[Conv] [5] (cm)	426.72 CM
[mm]	4267.2 MM

Note: When performing multiple conversions, you only have to press the **[Conv]** key once.

Converting Feet-Inch-Fractions to Decimal Feet

Convert 15 feet 9-1/2 inches to decimal feet. Then convert back to feet-inch-fractions.

<u>Keystroke</u>	<u>Display</u>
[On/C] [On/C]	0.
15 [Feet] 9 [Inch] 1 [/] 2	15 FEET 9-1/2 INCH
[Conv] [Feet]	15.79167 FEET
[Feet]	15 FEET 9-1/2 INCH

Converting Decimal Feet to Feet-Inch-Fractions

Convert 17.32 feet to feet-inch-fractions.

Keystroke	Display
[On/C] [On/C]	0.
17.32 [Feet]	17.32 FEET
[Conv] [Feet]	17 FEET 3-13/16 INCH

Converting Fractional Inches to Decimal Inches

Convert 8-1/8 inches to decimal inches. Then convert to decimal feet.

Keystroke	Display
[On/C] [On/C]	0.
8 [Inch] 1 [/] 8	8-1/8 INCH
[Conv] [Inch]	8.125 INCH
[Feet]	0.677083 FEET

Converting Decimal Inches to Fractional Inches

Convert 9.0625 inches to fractional inches. Then convert to decimal feet.

Keystroke	Display
[On/C] [On/C]	0.
9.0625 [Inch]	9.0625 INCH
[Conv] [Inch]	9-1/16 INCH
[Feet] [Feet]	0.755208 FEET

Square Conversions

Convert 14 square feet to other square dimensions:

Keystroke	Display
[On/C] [On/C]	0.
14 [Feet] [Feet] [Conv] [Inch]	2016. SQ INCH
[Yds]	1.555556 SQ YD
[m]	1.300643 SQ M
[Conv] [5] (cm)	13006.43 SQ CM
[mm]	1300643. SQ MM

Cubic Conversions

Convert 14 cubic feet to other cubic dimensions:

Keystroke	Display
[On/C] [On/C]	0.
14 [Feet] [Feet] [Feet] [Conv] [Inch]	24192. CU INCH
[Yds]	0.518519 CU YD
[m]	0.396436 CU M
[Conv] [5] (cm)	396435.9 CU CM
[mm]	0.396436 CU M*

*Note: The calculator's auto-range function displayed the answer in meters because the answer in millimeters is out of the calculator's normal 7-digit range. The Trig Plus III may show the result in mm using Exponential Notation format. If the Exponential Notation Preference is turned off, the calculator's auto-range function will display the result in a larger unit of measure (if possible) instead of displaying an error due to a display overflow (see Appendix E - Auto-Range).

PERFORMING BASIC MATH WITH DIMENSIONS

Adding Dimensions

<u>Keystroke</u>	<u>Display</u>
------------------	----------------

Add 11 inches to 2 feet 1 inch:

11 [Inch] [+]	2 [Feet] 1 [Inch] [=]	3 FEET 0 INCH
---------------	-----------------------	----------------------

Add 5 feet 7-1/2 inches to 18 feet 8 inches:

5 [Feet] 7 [Inch] 1 [/] 2 [+]	18 [Feet] 8 [Inch] [=]	24 FEET
		3-1/2 INCH

Subtracting Dimensions

<u>Keystroke</u>	<u>Display</u>
------------------	----------------

Subtract 3 feet from 11 feet 7-1/2 inches:

11 [Feet] 7 [Inch] 1 [/] 2 [-]	3 [Feet] [=]	8 FEET 7-1/2 INCH
----------------------------------	--------------	--------------------------

Subtract 32 inches from 81 inches:

81 [Inch] [-]	32 [Inch] [=]	49 INCH
---------------	---------------	----------------

Multiplying Dimensions

<u>Keystroke</u>	<u>Display</u>
------------------	----------------

Multiply 5 feet 3 inches by 11 feet 6-1/2 inches:

5 [Feet] 3 [Inch] [x]	11 [Feet] 6 [Inch] 1 [/] 2 [=]	60.59375 SQ FEET
-----------------------	----------------------------------	-------------------------

Multiply 2 feet 7 inches by 10:

2 [Feet] 7 [Inch] [x]	10 [=]	25 FEET 10 INCH
-----------------------	--------	------------------------

Dividing Dimensions

<u>Keystroke</u>	<u>Display</u>
------------------	----------------

Divide 30 feet 4 inches by 7 inches:

30 [Feet] 4 [Inch] [÷] 7 [Inch] [=]

52.

Divide 20 feet 3 inches by 9:

20 [Feet] 3 [Inch] [÷] 9 [=]

2 FEET 3 INCH

Percentage Calculations

The percent [%] key is used to find a given percent of a number or to perform add-on, discount or division percentage calculations. You may also perform percentage calculations with dimensional units (feet, inch, etc.), in any format (linear, square or cubic).

Examples:

<u>Keystroke</u>	<u>Display</u>
------------------	----------------

Find 18% of 500 feet:

500 [Feet] [x] 18 [%]

90 FEET 0 INCH

Add 10% to 137 square feet:

137 [Feet] [Feet] [+] 10 [%]

150.7 SQ FEET

Subtract 20% from 552 feet 6 inches:

552 [Feet] 6 [Inch] [-] 20 [%]

442 FEET 0 INCH

Divide 350 cubic yards by 80%:

350 [Yds] [Yds] [Yds] [÷] 80 [%]

437.5 CU YD

MEMORY OPERATION

Your calculator has two types of Memory operations:

- 1) a standard, cumulative, semi-permanent memory **[M+]**; and
- 2) two Storage Registers **[M1]** and **[M2]**, used to permanently store single, non-cumulative values.

Memory commands are listed below.

<u>Function</u>	<u>Keystrokes</u>
M+:	
Add value to M+	[M+]
Subtract value from M+	[Conv] [M+]
Clear M+ (<i>displays and clears M+</i>)	[Rcl] [Rcl]
Clear M+ (<i>clears M+ without displaying contents of memory</i>)	[Conv] [Rcl]
Review stored value	[Rcl] [M+]
M1/M2:	
Store single value in M1	[Stor] [1]
Store single value in M2	[Stor] [2]
Clear register M1	[0] [Stor] [1]
Clear register M2	[0] [Stor] [2]
Review stored value in M1	[Rcl] [1]
Review stored value in M2	[Rcl] [2]

i. Basic Cumulative Memory (M+)

Example:

Store 100 into M+, add 200, then subtract 50. Clear the Memory:

<u>Keystroke</u>	<u>Display</u>
100 [M+]	100. M
200 [M+]	200. M
50 [Conv] [M+]	50. M
[Rcl] [Rcl]	250.

Note: To Clear Memory (M+):

- press [Rcl] [Rcl];
- [Conv] [Rcl]; or
- turn off the calculator.

ii. Permanent Storage Registers (M1 and M2)

Examples:

Store a rate of \$175 into M1 and recall the value:

<u>Keystroke</u>	<u>Display</u>
175 [Stor] [1]	M-1 175.
[Off] [On/C]	0.
[Rcl] [1]	M-1 175.

Store 1,575 square yards into M2 and recall the value:

<u>Keystroke</u>	<u>Display</u>
1575 [Yds] [Yds] [Stor] [2]	M-2 1575. SQ YD
[Off] [On/C]	0.
[Rcl] [2]	M-2 1575. SQ YD

Note: To Clear M1/M2: Values stored in M1/M2 will remain **permanently stored**, even after you turn the calculator off. You will never need to clear the storage registers; simply enter a new value. However, if you wish to clear M1/M2 to "zero":

- Enter [0] [Stor] [1] and [0] [Stor] [2] or [Conv] [X] to clear the registers

PAPERLESS TAPE OPERATION

Note: Not available on DT (Desktop) Printer—Model #44065.

The Paperless Tape allows you to display and review the last twenty entries of a regular math or basic dimensional math string calculation.

To access this mode after entering values, press **[Rcl] [=]**. Then, press **[+]** or **[-]** to scroll forward or backward through the entries.

While in the Paperless Tape mode, the display will show the previously entered or calculated value, along with the sequence number of entry (e.g., 01, 02, 03, etc.) and the math operator (+, −, \times , \div , %) in the upper left corner of the display.

Note: If **[=]** has been used in the middle of a string, **SUB** (for Subtotal) will display in the upper left. If **[=]** was the last operation performed, the display will show **TTL** (Total) as the last entry.

To **exit** this mode, press **[=]** to exit and maintain the last entry on the display. When exiting, the last entry (or TTL) will be displayed, allowing you to continue using the last tape value for another operation, if desired.

Note: The Paperless Tape is cleared when:

- **[On/C]** is pressed twice;
- upon a new calculation (new equation string is started); or
- when the calculator is shut off.

Example:

<u>Keystroke</u>	<u>Display</u>
1. Enter a string of numbers:	
4 [Feet] [+]	4 FEET 0 INCH
5 [Feet] [+]	9 FEET 0 INCH
6 [Feet] [+]	15 FEET 0 INCH
7 [Feet] [=]	22 FEET 0 INCH
2. Access the tape function:	
[Rcl] [=]	TTL= 22 FEET 0 INCH
3. Scroll from first value to total:	
[+]	01 4 FEET 0 INCH
[+]	02+ 5 FEET 0 INCH
[+]	03+ 6 FEET 0 INCH
[+]	04+ 7 FEET 0 INCH
[+]	TTL = 22 FEET 0 INCH
4. Scroll last two values:	
[–]	04+ 7 FEET 0 INCH
[–]	03+ 6 FEET 0 INCH
5. Exit tape function and continue:	
[=]	TTL= 22 FEET 0 INCH
[+]	22 FEET 0 INCH
2 [Feet] [=]	24 FEET 0 INCH

EXAMPLES — USING THE CONSTRUCTION MASTER PRO

The *Construction Master Pro* calculators have keys and functions labeled in common building terms. Just follow the examples and adapt the keystrokes to your specific application.

Please note that the following examples may or may not apply to your specific calculator model (refer to the *Comparison Grid* on page 8).

Also, if you are using the *Trig Plus III*, some of your answers in this User's Guide may differ slightly, as the calculator has a default fractional resolution of 1/64" (versus 1/16" in other models). A special key-stroke, **[Conv] [1]**, temporarily sets the fractional setting to sixteenths in selected problems.

You may change your *Trig Plus III*'s fraction accuracy to sixteenths by pressing **[Conv]** then **[Stor]** to access the fractional setting. Press **[+]** until "1/16" shows in the display and press **[On/C]** to set and exit the fractional setting mode.

LINEAR MEASUREMENT EXAMPLES

Adding Linear Measurements

Find the total length of the following measurements: 5 feet 4-1/2 inches, 8 inches and 3.5 yards.

<u>Keystroke</u>	<u>Display</u>
1. Add the measurements:	
[On/C] [On/C]	0.
5 [Feet] 4 [Inch] 1 [/] 2 [+]	5 FEET 4-1/2 INCH
8 [Inch] [+]	6 FEET 0-1/2 INCH
3.5 [Yds]	3.5 YD
2. Find the total:	
[=]	16 FEET 6-1/2 INCH

Cutting Boards

How many 2 foot 2 inch pieces can be cut from one 10-foot board?

<u>Keystroke</u>	<u>Display</u>
Divide board length by smaller cuts:	
[On/C] [On/C]	0.
10 [Feet]	10 FEET
[÷] 2 [Feet] 2 [Inch] [=]	4.615385
	(or 4 whole pieces)

Window Measurement

What is the total width of three (3) window openings, if each measures 2 feet 5 inches in width?

<u>Keystroke</u>	<u>Display</u>
1. Enter window width:	
[On/C] [On/C] 2 [Feet] 5 [Inch]	0. 2 FEET 5 INCH
2. Find total width:	
[x] 3 [=]	7 FEET 3 INCH
3. Convert to decimal feet:	
[Feet]	7.25 FEET

Calculating the Center Point

You have a room that measures 13 feet 8 inches by 14 feet 10 inches. Find the center point to install a ceiling fan.

<u>Keystroke</u>	<u>Display</u>
1. Divide length in half, to figure first center point:	
[On/C] [On/C] 13 [Feet] 8 [Inch] [÷] 2 [=]	0. 13 FEET 8 INCH 6 FEET 10 INCH
2. Divide width in half, to figure second center point:	
14 [Feet] 10 [Inch] [÷] 2 [=]	14 FEET 10 INCH 7 FEET 5 INCH

Therefore, you should install the fan at the intersection of 6 feet 10 inches length and 7 feet 5 inches width.

AREA CALCULATIONS

Square Area (x^2)

What is the area of a square room with sides measuring 7 feet 4 inches?

<u>Keystroke</u>	<u>Display</u>
[On/C] [On/C]	0.
7 [Feet] 4 [Inch] [Conv] [%] (x^2)	53.77778 SQ FEET

Area of a Rectangular Room (LxW)

What is the area of a room measuring 12 feet 6 inches by 15 feet 8 inches?

<u>Keystroke</u>	<u>Display</u>
[On/C] [On/C]	0.
12 [Feet] 6 [Inch]	12 FEET 6 INCH
[x] 15 [Feet] 8 [Inch] [=]	195.8333 SQ FEET

VOLUME CALCULATIONS

Rectangular Containers (LxWxH)

What is the volume of a rectangular container that measures 3 feet by 1 foot 9-5/8 inches by 2 feet 4 inches?

<u>Keystroke</u>	<u>Display</u>
------------------	----------------

1. Find volume in cubic feet:

[On/C] [On/C]	0.
3 [Feet]	3 FEET
[x] 1 [Feet] 9 [Inch] 5 [/] 8	1 FEET 9-5/8 INCH
[x] 2 [Feet] 4 [Inch] [=]	12.61458 CU FEET*

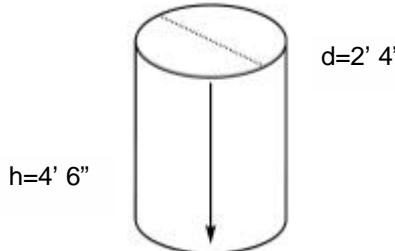
2. Convert to cubic yards:

[Conv] [Yds]	0.467207 CU YD
--------------	----------------

***Note:** If the “Volume Display Format” Preference Setting is set to cubic yards or cubic meters, your result will display accordingly. (See Preference Settings on page 96.)

Volume of a Cylinder

Calculate the volume of a cylinder with a diameter of 2 feet 4 inches and a height of 4 feet 6 inches:



Keystroke

1. *Find circle area:*

[On/C] [On/C]

2 [Feet] 4 [Inch]

[Circ] [Circ]

0.

2 FEET 4 INCH

AREA 4.276057 SQ FEET

2. *Enter height and find volume:**

4 [Feet] 6 [Inch] [Rise] [Column]

COL 19.24225 CU FEET

**Note: if using the LT, use the following keystrokes:*

[x] 4 [Feet] 6 [Inch] [=]

19.24225 CU FEET

Volume of a Cone

Calculate the volume of a cone with a diameter of 3 feet 6 inches and a height of 5 feet:

Keystroke

1. *Find circle area:*

[On/C] [On/C]

0.

3 [Feet] 6 [Inch]

[Circ] [Circ]

3 FEET 6 INCH

AREA 9.621128 SQ FEET

2. *Enter height and find volume:**

5 [Feet] [Rise] [Conv] [Column]

CONE 16.03521 CU FEET

**Note: if using the LT, use the following keystrokes:*

[x] 5 [Feet] [:] 3 [=]

16.03521 CU FEET

WEIGHT/VOLUME CONVERSIONS

Weight Conversions

Convert 2,500 pounds to kilograms, tons and metric tons:

<u>Keystroke</u>	<u>Display</u>
------------------	----------------

1. Enter pounds:

[On/C] [On/C]	0.
2500 [Conv] [4] (/bs)	2500 LB

2. Convert to kilograms, tons and metric tons:

[Conv] [1] (kg)	1133.981 kG
[Conv] [6] (tons)	1.25 Ton
[Conv] [3] (met tons)	1.133981 MET Ton

Weight per Volume/Volume Conversions

Convert 5 cubic yards of concrete to pounds, tons and kilograms, if concrete weighs 1.5 tons per cubic yard.

Keystroke	Display
1. <i>Store weight per volume:</i>	
[On/C] [On/C] 1.5 [Stor] [8]* (wt/vol)	0. 1.5 Ton Per CU YD
2. <i>Enter concrete volume:</i>	
5 [Yds] [Yds] [Yds]	5. CU YD
3. <i>Convert to pounds, tons and kilograms:</i>	
[Conv] [4] (lbs) [Conv] [6] (tons) [Conv] [1] (kg)	15000. LB 7.5 Ton 6803.886 kG

**Keep pressing the [8] key until the desired format is displayed (e.g., Ton Per CU YD, LB Per CU YD, LB Per CU FEET, Ton Per CU M, or kG Per CU M).*

BLOCKS/BRICKS

Number of Blocks (*not available on LT and Trig Plus III*)

You are building an "L" shaped retaining wall out of standard 8-inch x 16-inch size blocks (note: default block size). One side of the retaining wall is 22 feet long, and the other side is 15 feet 8 inches long. The wall is to be 4 feet high. How many blocks are required to build this wall? Add a 5% waste allowance.

Keystroke	Display
------------------	----------------

1. Find wall area:

[On/C] [On/C]	0.
[Rcl] [Block]*	B_AR 128. SQ INCH
22 [Feet] [+] 15 [Feet] 8 [Inch] [x]	37 FEET 8 INCH
4 [Feet] [=]	150.6667 SQ FEET

2. Find the number of blocks and add 5% waste allowance:

[Conv] [Block]	BLKS 169.5
[+] 5 [%]	177.975

*If **[Rcl] [Block]** does not result in 128 square inches, then enter the following:

8 [Inch] [x] 16 [Inch] [=]	128. SQ INCH
[Stor] [Block]	B_AR 128. SQ INCH

-OR-

128 [Stor] [Block]	B_AR 128. SQ INCH
--------------------	--------------------------

Number of “Face” Bricks (not available on LT and Trig Plus III)

How many “face” bricks (21 square inch size) will you need to purchase to fill a 40 foot by 8 foot wall, if you include a 3% waste allowance?

Keystroke	Display
------------------	----------------

1. Enter brick size into Block Size key:

[On/C] [On/C]	0.
21 [Stor] [Block]	B_AR 21. SQ INCH

2. Find area of wall:

40 [Feet] [x] 8 [Feet] [=]	320. SQ FEET
----------------------------	---------------------

3. Find the number of bricks and add a 3% waste allowance:

[Conv] [Block]	BLKS 2194.286 (Bricks)
[+] 3 [%]	2260.114

Number of “Paver” Bricks (not available on LT and Trig Plus III)

How many “paver” bricks (32 square inch size) will you need to fill a 5-foot by 15-foot walkway?

Keystroke	Display
------------------	----------------

1. Enter brick size into Block Size key:

[On/C] [On/C]	0.
32 [Stor] [Block]	B_AR 32. SQ INCH

2. Find area of walkway:

5 [Feet] [x] 15 [Feet] [=]	75. SQ FEET
----------------------------	--------------------

3. Find the number of bricks:

[Conv] [Block]	BLKS 337.5 (Bricks)
----------------	----------------------------

BOARD FEET — LUMBER ESTIMATION

The *Construction Master Pro* easily computes board feet for lumber estimation problems. Simply enter the board's cubic dimensions and press the **[Conv] [0]** keys to convert to board feet. Use the **[Conv] [9]**, or "Cost" function, to figure total lumber cost.

 **Note:** Unit cost is entered in the standard per thousand board foot measure (Mbm) format.

Total Board Feet — With Dollar Cost

Find the total board feet for the following board sizes:

2 x 4 x 14

2 x 10 x 16

2 x 12 x 18

If the boards cost \$250 per Mbmm., what is the total cost?

<u>Keystroke</u>	<u>Display</u>
------------------	----------------

1. Enter board sizes, convert to board feet and store in memory:

[On/C] [On/C]	0.
2 [x] 4 [x] 14 [Conv] [0] [M+]	9.333333 B FEET ^M
2 [x] 10 [x] 16 [Conv] [0] [M+]	26.666667 B FEET ^M
2 [x] 12 [x] 18 [Conv] [0] [M+]	36. B FEET ^M

2. Recall total board feet and compute total cost:

[Rcl] [Rcl] [x] 250 [Conv] [9] (Cost)	72. B FEET \$18.00
--	-----------------------

CIRCLE CALCULATIONS

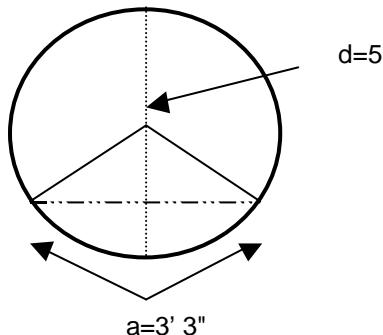
Circumference and Area of a Circle

Find the area and circumference of a circle with a diameter of 11 inches:

Keystroke	Display
[On/C] [On/C]	0.
11 [Inch] [Circ]	DIA 11 INCH
[Circ]	AREA 95.03318 SQ INCH
[Circ]	CIRC 34-9/16 INCH

Circle Properties — Arc Length and Diameter Known

Find the arc degree, chord length, rise, pie slice area and segment area of a circle, given a 5-foot diameter and an arc length of 3 feet 3 inches:



Keystroke	Display
-----------	---------

1. Enter circle diameter:

[On/C] [On/C]	0.
5 [Feet] [Circ]	DIA 5 FEET 0 INCH

2. Enter arc length:

3 [Feet] 3 [Inch] [Conv] [Circ]	ARC 3 FEET 3 INCH
	(Cont'd)

(Cont'd)

<u>Keystroke</u>	<u>Display</u>
------------------	----------------

3. *Find degree of arc:*

[Circ]

ARC 74.48°

4. *Find chord length:*

[Circ]

CORD 3 FEET 0-5/16 INCH

5. *Find segment rise:*

[Circ]

RISE 0 FEET 6-1/8 INCH

6. *Find pie slice area:*

[Circ]

PIE 4.0625 SQ FEET

7. *Find segment area:*

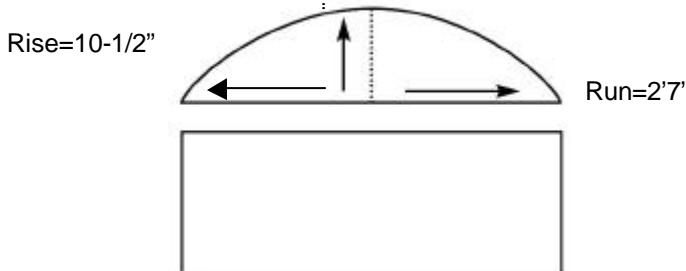
[Circ]

SEG 1.051381 SQ FEET

Note: Successive presses of [Circ] will toggle to the beginning.

Arched Windows

Find the radius of an arched window with a chord length of 2 feet 7 inches and a rise of 10-1/2 inches. Then, find the arc angle, arc length and segment area of the window.



Keystroke Display

1. Enter chord length:

[On/C] [On/C]
2 [Feet] 7 [Inch] [Run]

0.
RUN 2 FEET 7 INCH

2. Enter rise:

10 [Inch] 1 [/] 2 [Rise]

RISE 10-1/2 INCH

3. Find radius:

[Conv] [Diag]

RAD 16-11/16 INCH

4. Find arc angle:

[Conv] [Circ]

ARC 136.46°

5. Find arc length:

[Circ]

ARC 39-3/4 INCH

6. Find segment area:

[Circ] [Circ] [Circ] [Circ]

SEG 235.7767 SQ INCH

Arc Length — Degree and Diameter Known

Find the arc length of an 85° portion of a circle with a 5-foot diameter:

Keystroke	Display
[On/C] [On/C]	0.
5 [Feet] [Circ]	DIA 5 FEET 0 INCH
85 [Conv] [Circ]	ARC 85.00°
[Circ]	ARC 3 FEET 8-1/2 INCH

Arc Length — Degree and Radius Known

Find the arc length of a circle with a 24-inch radius and 77° of arc (77° of 360° circle):

Keystroke	Display
[On/C] [On/C]	0.
24 [Inch] [Conv] [Diag]	RAD 24 INCH
77 [Conv] [Circ]	ARC 77.00°
[Circ]	ARC 32-1/4 INCH

CONCRETE/PAVING

Volume of Concrete for a Driveway

Find the cubic yards of concrete required to pour a driveway with the following dimensions: 36 feet 3 inches long by 11 feet 6 inches wide by 4 inches deep. If concrete costs \$55 per cubic yard, what is the total cost?

Keystroke	Display
1. <i>Multiply length by width:</i>	
[On/C] [On/C]	0.
36 [Feet] 3 [Inch]	36 FEET 3 INCH
[x] 11 [Feet] 6 [Inch]	11 FEET 6 INCH
2. <i>Find area:</i>	
[=]	416.875 SQ FEET
3. <i>Multiply by depth to find volume:</i>	
[x] 4 [Inch] [=]	5.146605 CU YD*
4. <i>Multiply by per unit cost to find the total cost of concrete:</i>	
[x] 55 [Conv] [9] (Cost)	\$283.06

*Note: This answer will automatically display in cubic yards due to the multiplication of mixed units, unless the preference setting for volume display has been changed from the default Standard Setting. (See Preference Settings on page 96.)

Concrete Columns

Find the cubic yards of concrete required to pour five (5) columns, if each has a diameter of 3 feet 4 1/2 inches and a height of 11 feet 6 inches. If the concrete weighs 1.75 tons per cubic yard, what is the total weight in tons? In pounds? In kilograms?

Keystroke

Display

1. *Find circle area:*

[On/C] [On/C]	0.
3 [Feet] 4 [Inch] 1 [/] 2	3 FEET 4-1/2 INCH
[Circ] [Circ]	AREA 8.946176 SQ FEET

2. *Enter height, find total volume of concrete and add into Memory:*

For the Handheld and Desktop:

11 [Feet] 6 [Inch] [Rise]	RISE 11 FEET 6 INCH
[Column]	COL 102.881 CU FEET
[Conv] [Yds]	3.810408 CU YD
[x] 5 [=]	19.05204 CU YD
[M+]	19.05204 CU YD M

For the LT and Trig Plus III:

[x] 11 [Feet] 6 [Inch]	11 FEET 6 INCH
[=]	102.881 CU FEET
[Conv] [Yds]	3.810408 CU YD
[x] 5 [=]	19.05204 CU YD
[M+]	19.05204 CU YD M

3. *Enter weight in tons per cubic yards:*

1.75 [Stor] [8]	1.75 Ton Per CU YD M
-----------------	------------------------------------

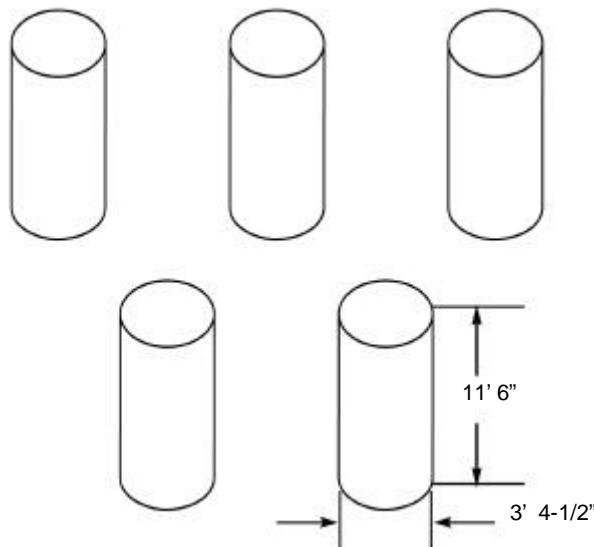
(Cont'd)

(Cont'd)

4. Recall Memory and find weights:

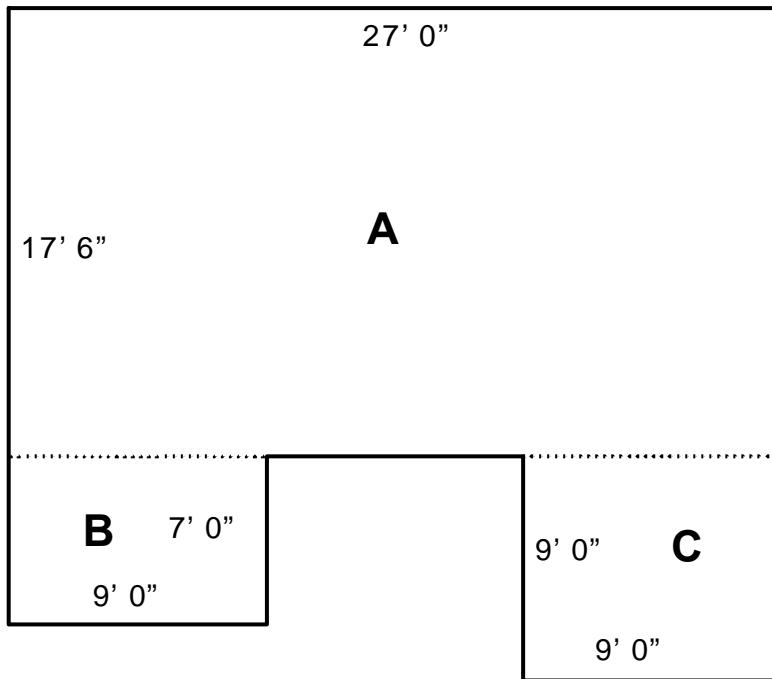
[Rcl] [Rcl]
[Conv] [6] (*tons*)
[Conv] [4] (*lbs*)
[Conv] [1] (*kg*)

19.05204 CU YD
33.34107 Ton
66682.14 LB
30246.51 kG



Complex Concrete Volume

You're going to pour an odd-shaped patio 4 1/2 inches deep with the dimensions shown below. Calculate the total area (by dividing the drawing into three rectangles) and determine the total yards of concrete required. Then, find the total cost, if concrete costs \$45 per cubic yard.



(Cont'd)

(Cont'd)

Keystroke	Display
1. Find area of Part A and store into Memory:	
[On/C] [On/C]	0.
17 [Feet] 6 [Inch] [-]	17 FEET 6 INCH
7 [Feet] [=]	10 FEET 6 INCH
[x] 27 [Feet] [=]	283.5 SQ FEET
[M+]	283.5 SQ FEET M
2. Find area of Part B and store into Memory:	
7 [Feet]	7 FEET M
[x] 9 [Feet] [=]	63. SQ FEET M
[M+]	63. SQ FEET M
3. Find area of Part C and store into Memory:	
9 [Feet]	9 FEET M
[x] 9 [Feet] [=]	81. SQ FEET M
[M+]	81. SQ FEET M
4. Find total area and clear memory:	
[Rcl] [Rcl]	427.5 SQ FEET
5. Find total cubic yards:	
[x] 4 [Inch] 1 [/] 2 [=]	5.9375 CU YD
6. Find total cost:	
[x] 45 [Conv] [9] (Cost)	\$267.19

Concrete Footings (not available on Trig Plus III)

Find the volume of concrete required for a (16 inch by 8 inch) footing that measures 232 feet 6 inches in length.

<u>Keystroke</u>	<u>Display</u>
-------------------------	-----------------------

1. *Enter footing area:*

[On/C] [On/C] 16 [Inch] [x] 8 [Inch] [=] [Stor] [Ftg]	0. F-AR 128. SQ INCH
--	--------------------------------

2. *Enter length to find volume:*

232 [Feet] 6 [Inch] [Conv] [Ftg]	FTG 7.654321 CU YD
----------------------------------	---------------------------

Multiple Concrete Footings (not available on Trig Plus III)

Find the total volume of concrete required to pour five (5) 24-inch by 12-inch footings, each 5 feet in length.

<u>Keystroke</u>	<u>Display</u>
-------------------------	-----------------------

1. *Enter footing area:*

[On/C] [On/C] 24 [Inch] [x] 12 [Inch] [=] [Stor] [Ftg]	0. F-AR 288. SQ INCH
---	--------------------------------

2. *Enter length to find volume:*

5 [Feet] [Conv] [Ftg]	FTG 0.37037 CU YD
-----------------------	--------------------------

3. *Multiply by 5 footings to find total concrete volume:*

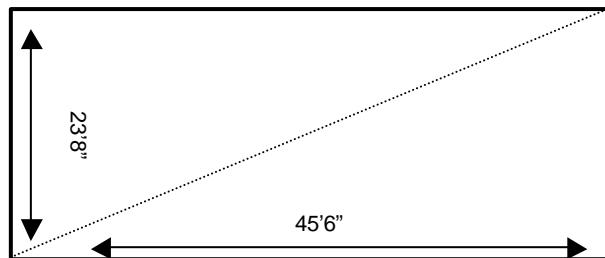
[x] 5 [=]	1.851852 CU YD
-----------	-----------------------

4. *Clear and return stored footing size to default:*

[Conv] [x]	0.
------------	----

Squaring Up a Foundation

A concrete foundation measures 45 feet 6 inches by 23 feet 8 inches. Find the diagonal measurement (square up) to ensure the form is perfectly square.



<u>Keystroke</u>	<u>Display</u>
------------------	----------------

1. Enter sides as rise/run:

[On/C] [On/C]
23 [Feet] 8 [Inch] [Rise]
45 [Feet] 6 [Inch] [Run]

0.
RISE 23 FEET 8 INCH
RUN 45 FEET 6 INCH

2. Find the square up (diagonal):

[Diag]

DIAG 51 FEET 3-7/16 INCH

FLOOR COVERING AREA CALCULATIONS

Carpeting

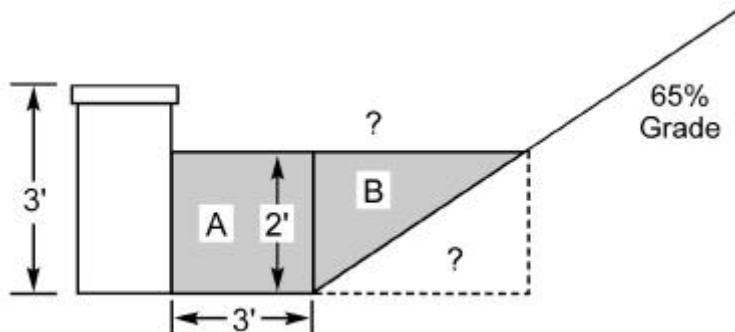
You need to replace the carpet in two rooms, with dimensions as follows: (Room #1) 12 feet 4 inches x 10 feet; (Room #2) 14 feet 8 inches x 16 feet. Find the total square yards of carpet required.

Keystroke	Display
1. Find area of Room #1 and add to memory:	
[On/C] [On/C] 12 [Feet] 4 [Inch] [x] 10 [Feet] [=] [M+]	0. 12 FEET 4 INCH 123.3333 SQ FEET^M
2. Find area of Room #2 and add to memory:	
14 [Feet] 8 [Inch] [x] 16 [Feet] [=] [M+]	14 FEET 8 INCH^M 234.6667 SQ FEET^M
3. Find total square yards (while clearing memory):	
[Rcl] [Rcl] [Conv] [Yds]	39.77778 SQ YD

GRADE/SLOPE

Back-Fill on a Slope — Percent of Grade Known

You've built 55 linear feet of a 3 foot high retaining wall that is 3 feet from the base of a 65% grade. You need to pour back-fill within 12 inches of the top of the wall (for a 2 foot depth). How many cubic yards of fill should you have delivered?



Keystroke

1. Find volume for "A":

[On/C] [On/C]
55 [Feet]
[x] 3 [Feet]
[x] 2 [Feet] [=] [M+]

Display

0.
55 FEET
3 FEET
330. CU FEET

2. Find run/diagonal of "B":

65 [%] [Pitch]
2 [Feet] [Rise]
[Run]*
[Diag]*

PTCH 0.65
RISE 2 FEET 0 INCH
RUN 3 FEET 0-15/16 INCH
DIAG 3 FEET 8-1/16 INCH

*The Trig Plus III will have a higher fractional accuracy when displaying these values. If you desire to match the results as shown, press [Conv] [1] to temporarily set fractional accuracy to one sixteenth, or use the Preference Setting to permanently set the calculator to one sixteenth.

(Cont'd)

(Cont'd)

<u>Keystroke</u>	<u>Display</u>
------------------	----------------

3. *Find volume of triangle "B":*

55 [Feet]

[x] [Rcl] [Run]

[x] 2 [Feet] [=]

[÷] 2 [=] [M+]

55 FEET^M

RUN 3 FEET 0-15/16 INCH^M

338.4615 CU FEET^M

169.2308 CU FEET^M

4. *Find total volume:*

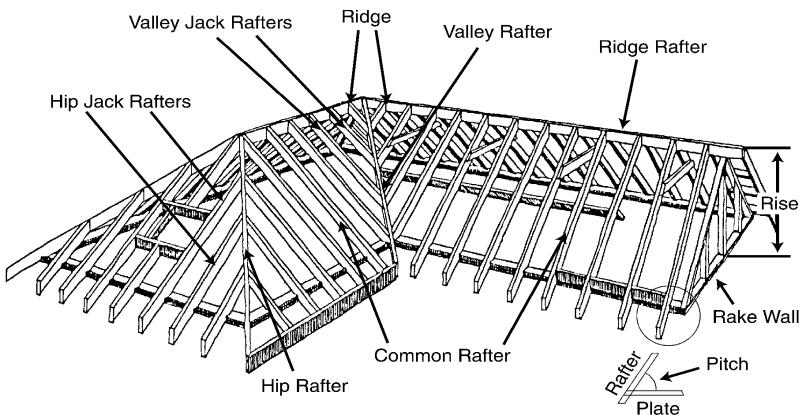
[Rcl] [Rcl]

[Conv] [Yds]

499.2308 CU FEET

18.49003 CU YD

RIGHT TRIANGLE AND ROOF FRAMING EXAMPLES



ROOF FRAMING DEFINITIONS

Rise: The vertical distance measured from the wall's top plate to the intersection of the pitch line and the center of the ridge.

Span: The horizontal distance or full width between the outside edges of the wall's top plates.

Run: The horizontal distance between the outside edge of the wall's top plate and the center of the ridge; in most cases this is equivalent to half of the span.

Pitch: Pitch and slope are synonymous in modern trade language. Pitch/slope of a roof is generally expressed in two types of measurement:

- 1) *Ratio of rise to run — 7/12 or 7 inch*
- 2) *Angle of rafters, in degrees — 30.26°*

Unit Rise: The number of inches of rise per foot (12 inches) of run.

Unit Run: This number is expressed as one foot (12 inches). In metric mode, or when using metric dimensions, the unit run is one meter.

Plate: The top horizontal wall member that the ceiling joist and rafters sit on and fasten to.

Ridge: The uppermost point of two roof planes.

Ridge Rafter: Also known as the “King rafter,” this rafter is the uppermost rafter that all Hip, Valley, Valley Jack and Common rafters are fastened to.

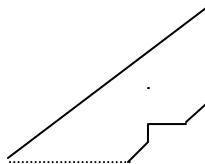
Rafters: Rafters are inclined roof support members. Rafters include the following types:

- **Common Rafter:** The Common connects the plate to the ridge and is perpendicular to the ridge.
- **Hip Rafter:** The Hip rafter extends from the corner of two wall plates to the ridge or King rafter at angle other than 90°. The Hip rafter is an external angle of two planes.
- **Valley Rafter:** The Valley rafter extends from the corner of two wall plates to the ridge or King rafter at angle other than 90°. The Valley rafter is an internal angle of two planes.
- **Jack Rafters:** Rafters that connect the Hip or Valley rafter to the wall plate.
- **Irregular Hip/Valley Jacks:** Jack rafters found in dual pitch or “irregular” roofs.

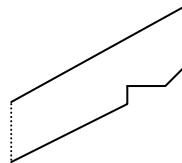
Regular Roof: A standard roof where the Hips and/or Valleys run at 45° and have the same pitch/slope on both sides of the Hip and/or Valley.

Irregular Roof: A non-standard roof where the Hips and/or Valleys bisect two different pitches/slopes, or have “skewed wings” or irregular Jacks.

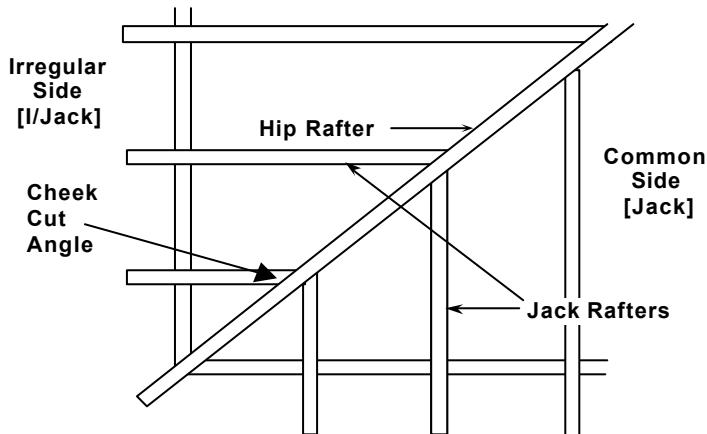
Rake Wall: A gable end wall that follows the pitch/slope of a roof.



Level Cut Angle



Plumb Cut Angle



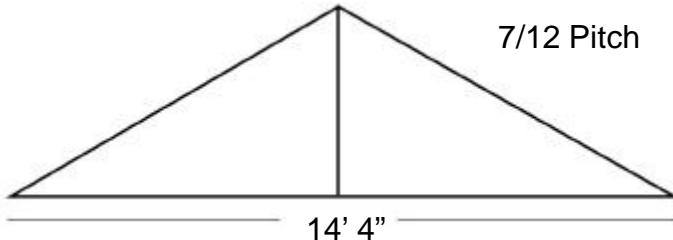
Plumb: Vertical Cut. The angle of cut from the edge of the board that allows the rafter to mate on the vertical side of the ridge rafter.

Level: Horizontal Cut. The angle of cut from the edge of the board that allows the rafter to seat flat on the wall plate.

Cheek: Side Cut(s). The angle to cut from the SIDE of the Jack rafter to match up against the Hip or Valley rafter, usually made by tilting the blade from 90°. Jack rafters typically have one Cheek cut. If there is only one pitch (no irregular pitch), the angle will be 45°. If there are two pitches, each side will have a different Cheek cut for the Jack rafter and the angles will total 90°.

Common Rafter Length

If a roof has a 7/12 pitch and a span of 14 feet 4 inches, what is the point-to-point length of the Common rafter (excluding the overhang or ridge adjustment)? What are the Plumb and Level cuts?



<u>Keystroke</u>	<u>Display</u>
1. Find diagonal or point-to-point length of the Common rafter:	
[On/C] [On/C]	0.
7 [Inch] [Pitch]	PTCH 7 INCH
14 [Feet] 4 [Inch] [=] 2 [=]	7 FEET 2 INCH
[Run]	RUN 7 FEET 2 INCH
[Diag]	DIAG 8 FEET 3-9/16 INCH
2. Find Plumb and Level cuts:	
[Diag]	PLMB 30.26°
[Diag]	LEVL 59.74°

Common Rafter Length — *Pitch Unknown*

Find the Common rafter length for a roof with a rise of 6 feet 11-1/2 inches and a run of 14 feet 6 inches. Solve for the pitch in inches and degrees.

<u>Keystroke</u>	<u>Display</u>
<i>Find diagonal and pitch:</i>	
[On/C] [On/C]	0.
[Conv] [1]*	0.
6 [Feet] 11 [Inch] 1 [/] 2 [Rise]	RISE 6 FEET 11-1/2 INCH
14 [Feet] 6 [Inch] [Run]	RUN 14 FEET 6 INCH
[Diag]	DIAG 16 FEET 1 INCH
[Pitch]	PTCH 25.64°
[Pitch]	PTCH 5-3/4 INCH

**Optional keystroke, which temporarily sets the fractional accuracy to one-sixteenth (over-riding the Trig Plus III's default 1/64 setting).*

Angle and Diagonal (Hypotenuse)

Find the diagonal (hypotenuse) and degree of angle of a right triangle that is 9 feet high and 12 feet long.

<u>Keystroke</u>	<u>Display</u>
<i>1. Enter rise and run:</i>	
[On/C] [On/C]	0.
9 [Feet] [Rise]	RISE 9 FEET 0 INCH
12 [Feet] [Run]	RUN 12 FEET 0 INCH
<i>2. Solve for diagonal/hypotenuse and degree of angle:</i>	
[Diag]	DIAG 15 FEET 0 INCH
[Pitch]	PTCH 36.87°
[Pitch]	PTCH 9 INCH

Rise

Find the rise given a 7/12 pitch and a run of 11 feet 6 inches.

<u>Keystroke</u>	<u>Display</u>
[On/C] [On/C]	0.
7 [Inch] [Pitch]	PTCH 7 INCH
11 [Feet] 6 [Inch] [Run]	RUN 11 FEET 6 INCH
[Rise]	RISE 6 FEET 8-1/2 INCH

Rise and Diagonal

Find the rise and diagonal of a right triangle given a 30° pitch and a run of 20 feet 4 inches.

<u>Keystroke</u>	<u>Display</u>
[On/C] [On/C]	0.
30 [Pitch]	PTCH 30.00°
20 [Feet] 4 [Inch] [Run]	RUN 20 FEET 4 INCH
[Rise]	RISE 11 FEET 8-7/8 INCH
[Diag]	DIAG 23 FEET 5-3/4 INCH

Finding Sheathing Cut

You have framed an equal pitch roof and need to apply the roof sheathing. Find the distance from the corner of the sheathing so that you can finish the run at the Hip rafter and cut the material. The pitch is 6 inches and you are using 4-foot by 8-foot plywood, with the 8-foot side along the plate.

<u>Keystroke</u>	<u>Display</u>
1. <i>Enter pitch:</i> [On/C] [On/C] 6 [Inch] [Pitch]	0. PTCH 6 INCH
2. <i>Enter width of plywood:</i> 4 [Feet] [Diag]	DIAG 4 FEET 0 INCH
3. <i>Find length of sheathing:</i> [Run]	RUN 3 FEET 6-15/16 INCH

Regular (45°) Hip/Valley and Jack Rafters (*not available on LT*)

You're working with a 7/12 pitch, and half your total span is 8 feet 5 inches:

- (1) Find point-to-point length and cut angles for the Common rafter;
- (2) Find the length and cut angles of the adjoining Hip (or Valley) and;
- (3) Find the regular Jack rafter lengths and cut angles (Jack rafters at 16 inches on-center spacing).

Keystroke	Display
------------------	----------------

1. Find Common rafter length and Plumb and Level cuts:

[On/C] [On/C]	0.
[Conv] [1] (Temporarily sets fractional setting to 1/16)*	0.
8 [Feet] 5 [Inch] [Run]	RUN 8 FEET 5 INCH
7 [Inch] [Pitch]	PTCH 7 INCH
[Diag]	DIAG 9 FEET 8-15/16 INCH
[Diag]	PLMB 30.26°
[Diag]	LEVEL 59.74°

2. Find Hip/Valley rafter length and cut angles:

[Hip/V]	H/V 12 FEET 10-1/2 INCH
[Hip/V]	PLMB 22.42°
[Hip/V]	LEVEL 67.58°
[Hip/V]	CHK1 45.00°

***Note:** If using the Trig Plus III, you may obtain the same answers (displayed in fractional accuracy of sixteenths versus sixty-fourths) by pressing [Conv] [1] as indicated, or by changing the Preference Setting by pressing [Conv] [Stor], then [+] until 1/16 is shown in the display.

(Cont'd)

(Cont'd)

<u>Keystroke</u>	<u>Display</u>
[Jack]	JKOC 16 INCH*
[Jack]	JK1 8 FEET 2-3/8 INCH
[Jack]	JK2 6 FEET 7-7/8 INCH
[Jack]	JK3 5 FEET 1-3/8 INCH
[Jack]	JK4 3 FEET 6-13/16 INCH
[Jack]	JK5 2 FEET 0-5/16 INCH
[Jack]	JK6 0 FEET 5-13/16 INCH
[Jack]	JK7 0 FEET 0 INCH
[Jack]	PLMB 30.26°
[Jack]	LEVL 59.74°
[Jack]	CHK1 45.00°

*Note: If display does not read JKOC 16 INCH (the default), then reset by pressing 16 [Inch] [Stor] [7].

Jack Rafters — Using Other Than 16 Inch On-Center Spacing (not available on LT)

A roof has a 9/12 pitch and a run of 6 feet 9 inches. Find the Jack rafter lengths and cut angles at 18-inch (versus 16-inch) on-center spacing.

<u>Keystroke</u>	<u>Display</u>
-------------------------	-----------------------

1. Enter pitch, run and spacing:

[On/C] [On/C]	0.
9 [Inch] [Pitch]	PTCH 9 INCH
6 [Feet] 9 [Inch] [Run]	RUN 6 FEET 9 INCH
18 [Inch] [Stor] [7]	OC 18 INCH

2. Find Jack rafter lengths and cut angles:

[Jack]	JKOC 18 INCH
[Jack]	JK1 6 FEET 6-3/4 INCH
[Jack]	JK2 4 FEET 8-1/4 INCH
[Jack]	JK3 2 FEET 9-3/4 INCH
[Jack]	JK4 0 FEET 11-1/4 INCH
[Jack]	JK5 0 FEET 0 INCH
[Jack]	PLMB 36.87°
[Jack]	LEVL 53.13°
[Jack]	CHK1 45.00°

Irregular (non-45°) Hip/Valley and Jack Rafters — Descending, with On-Center Spacing Maintained (not available on LT)

You're working with a 7/12 pitch and half your overall span is 4 feet. The irregular pitch is 8/12, and 16 inch on-center spacing is maintained on both sides. Complete the following steps:

- (1) Find the length of the Common rafter;
- (2) Reset calculator to 16 inch on-center spacing;
- (3) Enter the irregular pitch; find the length of the adjoining "irregular" Hip (or Valley) and the cut angles;
- (4) Find the Jack lengths on the "irregular" pitch side (16 inch on-center spacing);
- (5) Find the cut angles;
- (6) Find the Jack lengths on the "regular" pitch side (16 inch on-center spacing);
- (7) Find the cut angles.

<u>Keystroke</u>	<u>Display</u>
1. <i>Find Common rafter length:</i>	

[On/C] [On/C]	0.
[Conv] [1] <i>(Temporarily sets fractional rounding to 1/16)</i>	0.
7 [Inch] [Pitch]	PTCH 7 INCH
4 [Feet] [Run]	RUN 4 FEET 0 INCH
[Diag]	DIAG 4 FEET 7-9/16 INCH

2. <i>Enter on-center spacing:</i>	
16 [Inch] [Stor] [7]	OC 16 INCH

3. <i>Find irregular Hip/Valley rafter length and cut angles:</i>	
8 [Inch] [Conv] [Hip/V]	IPCH 8 INCH
[Hip/V]	IH/V 5 FEET 9-11/16 INCH
[Hip/V]	PLMB 23.70°
[Hip/V]	LEVL 66.30°
[Hip/V]	CHK1 41.19°
[Hip/V]	CHK2 48.81°
	(Cont'd)

(Cont'd)

<u>Keystroke</u>	<u>Display</u>
------------------	----------------

4. *Find irregular Jack lengths:*

[Conv] [Jack]	IJOC 16 INCH
[Jack]*	IJ1 2 FEET 9-5/8 INCH
[Jack]	IJ2 1 FEET 4-13/16 INCH
[Jack]	IJ3 0 FEET 0 INCH

*Note: It is not necessary to continue pressing [Conv] when displaying each Jack rafter size.

5. *Find irregular Jack Plumb, Level and Cheek cut angles:*

[Jack]	PLMB 33.69°
[Jack]	LEVL 56.31°
[Jack]	CHK1 41.19°

6. *Find regular Jack lengths:*

[Jack]	JKOC 16 INCH
[Jack]	JK1 2 FEET 10-3/8 INCH
[Jack]	JK2 1 FEET 1-1/4 INCH
[Jack]	JK3 0 FEET 0 INCH

7. *Find regular Jack Plumb, Level and Cheek cut angles:*

[Jack]	PLMB 30.26°
[Jack]	LEVL 59.74°
[Jack]	CHK1 48.81°

Irregular (non-45°) Hip/Valley and Jack Rafters — Ascending, with Jacks Mating at Hip/Valley (not available on LT)

You're working with a 7/12 pitch and half your overall span is 4 feet. The irregular pitch is 8/12, and the Jacks need to mate at the Hip. The maximum allowable on-center spacing is 16 inches. Find the Jack rafter sizes from smallest to largest (ascending order). Complete the following steps:

- (1) Set Preference display to "JK ASCEND" (Jack sizes in ascending order);
- (2) Set Preference display to "IRJK JAC-JAC" (Jacks mate);
- (3) Find the length of the Common rafter;
- (4) Find the length of the adjoining "irregular" Hip (or Valley) and the cut angles;
- (5) Find the o.c., Jack lengths and cut angles on the "irregular" pitched side;
- (6) Find the o.c., Jack lengths and cut angles on the "regular" pitched side.

Note: After completing this example, you may need to reset the Preferences back to "IRJK OC-OC" if you do not normally figure Jacks in this manner. (See Preference Settings on page 96.)

Keystroke	Display
1. Review Preferences until you find "Jack Descend":	
[On/C] [On/C]	0.
[Conv] [Stor]	FRAC 0-1/16 INCH
(If not at 1/16, press [+] until 1/16 is displayed)	
[Stor]	AREA Std.
[Stor]	VOL Std.
[Stor]	RAKE dESCEnd
[Stor]	JACK dESCEnd
Set Preference to "Ascend":	
[+] (plus sign)	JACK ASCEnd
2. Set Preference to "Jacks Mate":	
[Stor]	IRJK OC-OC
[+] (plus sign)	IRJK JAC-JAC
	(Cont'd)

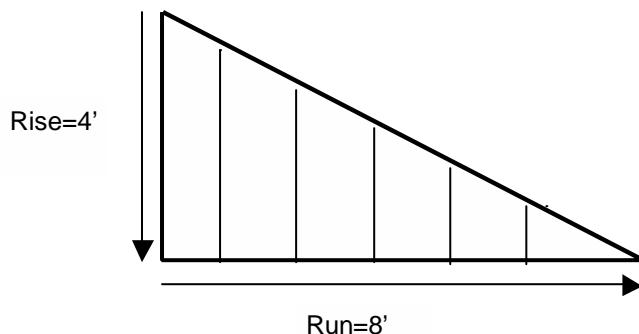
(Cont'd)

<u>Keystroke</u>	<u>Display</u>
3. Find Common rafter length:	
7 [Inch] [Pitch]	PTCH 7 INCH
4 [Feet] [Run]	RUN 4 FEET 0 INCH
[Diag]	DIAG 4 FEET 7-9/16 INCH
4. Enter irregular pitch and find irregular Hip/Valley rafter length and cut angles:	
8 [Inch] [Conv] [Hip/V]	IPCH 8 INCH
[Hip/V]	IH/V 5 FEET 9-11/16 INCH
[Hip/V]	PLMB 23.70°
[Hip/V]	LEVL 66.30°
[Hip/V]	CHK1 41.19°
[Hip/V]	CHK2 48.81°
5. Find the o.c., irregular Jack lengths and cut angles:	
[Conv] [Jack]	IJOC 16 INCH*
[Jack]	IJ1 1 FEET 4-13/16 INCH
[Jack]	IJ2 2 FEET 9-5/8 INCH
[Jack]	IJ3 4 FEET 2-1/2 INCH
[Jack]	PLMB 33.69°
[Jack]	LEVL 56.31°
[Jack]	CHK1 41.19°
6. Find the o.c., regular Jack lengths and cut angles:	
[Jack]	JKOC 14 INCH*
[Jack]	JK1 1 FEET 6-1/2 INCH
[Jack]	JK2 3 FEET 1-1/16 INCH
[Jack]	JK3 4 FEET 7-9/16 INCH
[Jack]	PLMB 30.26°
[Jack]	LEVL 59.74°
[Jack]	CHK1 48.81°

*Note: The stored on-center spacing is used as the maximum allowable spacing. Therefore, it is assigned to the side with the largest entered pitch. In this example, the "irregular" side pitch is larger than the "regular" side pitch; thus, the irregular side is calculated using the maximum on-center value (16 inches). If the regular pitch side had the larger pitch, it would require the larger (16 inches) on-center.

Rake Wall – No Base

Find each stud size in a Rake Wall with a peak of 4 feet, and a length of 8 feet. Use 16 inches as your spacing.



Note: The wall has no base.

Keystroke **Display**

1. Enter rise, run and o.c. spacing:

[On/C] [On/C]

0.

4 [Feet] [Rise]

RISE 4 FEET 0 INCH

8 [Feet] [Run]

RUN 8 FEET 0 INCH

[Rcl] [7]*

OC 16 INCH

*If 16 is not displayed, enter 16 [Stor] [7].

(Cont'd)

(Cont'd)

<u>Keystroke</u>	<u>Display</u>
------------------	----------------

2. *Find stud lengths:*

[Conv] [Rise] (R/Wall)	OC 16 INCH
[Rise]	RW 1 3 FEET 4 INCH
[Rise]	RW 2 2 FEET 8 INCH
[Rise]	RW 3 2 FEET 0 INCH
[Rise]	RW 4 1 FEET 4 INCH
[Rise]	RW 5 0 FEET 8 INCH
[Rise]	BASE 0 FEET 0 INCH

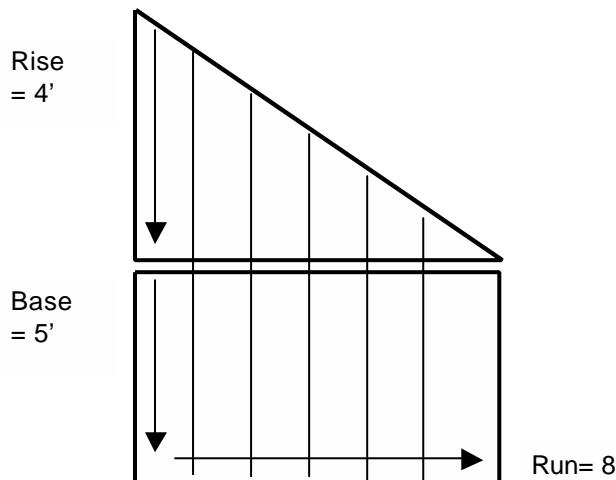
3. *Find Rake Wall angle of incline:*

[Rise]	RW 26.57°
--------	------------------

Note: By setting the Rake "Ascend" Preference (see Preference Settings on page 96), you may view Rake Wall stud lengths from smallest to largest size.

Rake Wall – With Base

Find each stud size in a Rake Wall with a peak of 4 feet, a length of 8 feet, and a base of 5 feet. Use 16 inches as your on-center spacing.



Keystroke Display

1. Enter rise, run, and o.c. spacing:

[On/C] [On/C]

0.

4 [Feet] [Rise]

RISE 4 FEET 0 INCH

8 [Feet] [Run]

RUN 8 FEET 0 INCH

[Rcl] [7]*

OC 16 INCH

*If 16 is not displayed, enter 16 [Stor] [7].

2. Enter base and find stud lengths and angle of incline:

5 [Feet] [Conv] [Rise] (R/Wall)

OC 16 INCH

[Rise]

RW 1 8 FEET 4 INCH

[Rise]

RW 2 7 FEET 8 INCH

[Rise]

RW 3 7 FEET 0 INCH

[Rise]

RW 4 6 FEET 4 INCH

[Rise]

RW 5 5 FEET 8 INCH

[Rise]

BASE 5 FEET 0 INCH

[Rise]

RW 26.57°

ROOFING MATERIALS

Roof Covering — Bundles of Roof Shingles (not available on LT and Trig Plus III)

How many bundles of roof shingles will you need for a 10-inch pitch roof covering a floor area of 14 feet by 11 feet?

<u>Keystroke</u>	<u>Display</u>
------------------	----------------

1. Enter pitch and floor area:

[On/C] [On/C]	0.
10 [Inch] [Pitch]	PTCH 10 INCH
14 [Feet] [x] 11 [Feet] [=]	154. SQ FEET

2. Find roof area:

[Conv] [Roof]	ROOF 200.4631 SQ FEET
---------------	-----------------------

3. Find number of bundles:

[Roof]	BNDL 6.01
--------	-----------

Note: If using the Construction Master Desktop, enter square footage then press **[Conv] [00]** then **[00]** for number of roof bundles.

Note: If entering a roof area instead of a floor area, be sure to enter zero for pitch.

Roof Covering — Number of Shingles

You're going to use 12-inch wide by 36-inch long asphalt (strip) shingles with 5-inch weather exposure. How many shingles are required for a roof measuring 1,745 square feet? Add a 10% waste allowance.

Note: *Shingle Exposure Area = exposure x length, plus Number of Shingles = roof area ÷ shingle exposure area.*

Keystroke	Display
------------------	----------------

1. *Find and save Shingle Exposure Area:*

[On/C] [On/C]	0.
5 [Inch] [x] 36 [Inch] [=]	180. SQ INCH
[M+]	180. SQ INCH 

2. *Find total Number of Shingles:*

1745 [Feet] [Feet]	1745. SQ FEET 
[÷] [Rcl] [M+] [=]	1396. (shingles) 

3. *Add 10% for waste:*

[+] 10 [%]	1535.6 (1536 shingles) 
------------	--

4. *Clear memory and display:*

[Rcl] [Rcl] [On/C]	0.
--------------------	----

Area for Roofing Materials

Find the number of roofing rolls needed to cover a roof with a 5/12 pitch, an overall span of 27 feet and a length of 34 feet 6 inches. The rolls measure 25 square feet each.

<u>Keystroke</u>	<u>Display</u>
-------------------------	-----------------------

For the Handheld and Desktop:

1. Enter pitch and find area of roof:

[On/C] [On/C]	0.
5 [Inch] [Pitch]	PTCH 5 INCH
27 [Feet] [x] 34 [Feet] 6 [Inch] [=]	931.5 SQ FEET
[Roof] (or [Conv] [00])	ROOF 1009.125 SQ FEET

2. Find number of rolls:

[÷] 25 [Feet] [Feet] [=]	40.365 (rolls)
--------------------------	----------------

For the LT and Trig Plus III:

1. Find Common rafter length:

[On/C] [On/C]	0.
5 [Inch] [Pitch]	PTCH 5 INCH
27 [Feet] [÷] 2 [=] [Run]	RUN 13 FEET 6 INCH
[Diag]	DIAG 14 FEET 7-1/2 INCH

2. Find area of one side:

[x] 34 [Feet] 6 [Inch] [=]	504.5625 SQ FEET
----------------------------	------------------

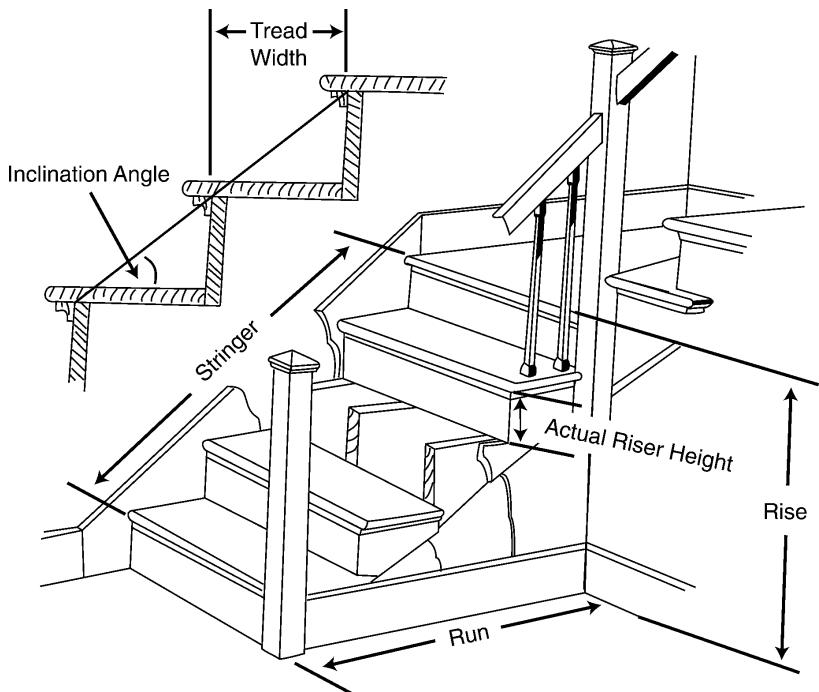
3. Find area of both sides:

[x] 2 [=]	1009.125 SQ FEET
-----------	------------------

4. Find number of rolls:

[÷] 25 [Feet] [Feet] [=]	40.365 (rolls)
--------------------------	----------------

STAIR LAYOUT EXAMPLES



STAIR LAYOUT DEFINITIONS

Rise: The “floor-to-floor” or “landing-to-landing” rise is the actual vertical rise required for building a stairway after the finish flooring has been installed.

Run: The run of a stairway is the amount of horizontal space required. The total run of a stairway is equal to the width of each tread multiplied by the number of treads.

Desired Riser Height: The desired riser height is the amount of vertical rise you allow for each individual riser in the stairway. This is sometimes dictated by local code.

Actual Riser Height: The actual height of each riser is measured from the top of one tread to the top of the next tread.

Number of Risers: The number of risers includes both the first and the last riser of the stairway.

Riser Overage or Underage: The riser overage or underage is the difference between the “floor-to-floor” rise and the total height of all of the risers. Many times the riser height does not divide evenly into the floor-to-floor rise and a small fraction of an inch is left over. A positive remainder is an overage, while a negative remainder is an underage.

Tread Width: The width of each tread is measured from the front of one riser to the front of the next riser. The width of each tread does NOT include the nosing or overhang of the tread, when a nosing or overhang is used. (The nosing or overhang of a tread is the rounded front of the tread that projects beyond the face of the riser.)

Number of Treads: The number of treads is one less than the number of risers.

Tread Overage or Underage: The tread overage or underage is the difference between the run or horizontal space that a stairway must fit into and the total width of the treads. Similar to the riser overage/underage, many times the total width of the treads does not divide evenly into the run or horizontal space for the stairway and a small fraction of an inch is left over. A positive remainder is an overage, a negative remainder is an underage.

Stringers: Also called carriages, stair horses or stair jacks. Stringers are the diagonal members that support the treads and risers.

Angle of Incline: The angle of incline of the stairway is determined by the rise and run of each stair. The angle of incline should not be confused with the pitch of the stairway. The pitch of a stairway is the angle based on the floor-to-floor rise and the horizontal run of the stairway. The angle of incline is based on the “actual” riser height and the “actual” tread width of the stair.

Stairs — Given Floor-to-Floor Rise

You're building a stairway with a total rise of 9 feet 11 inches. Your desired riser height is 7-1/2 inches and desired tread width is 10 inches. Find the riser height; number of risers; riser underage/overage; tread width; number of treads; tread underage/overage; stringer length; and angle of incline.

Keystroke	Display
1. Enter known rise:	
[On/C] [On/C] 9 [Feet] 11 [Inch] [Rise]	0. RISE 9 FEET 11 INCH
2. Recall stored desired stair riser height:	
[Rcl] [Stair]	R-HT 7-1/2 INCH
3. Recall stored desired stair tread width:	
[Rcl] [m]	T-WD 10 INCH
4. Find stair values:	
[Stair]	R-SZ 7-7/16 INCH
[Stair]	RSRS 16.
[Stair]	R+/- 0 INCH
[Stair]	T-WD 10 INCH
[Stair]	TRDS 15.
[Stair]	T+/- 0 INCH
[Stair]	STRG 15 FEET 6-15/16 INCH
[Stair]	INC° 36.64°

Stairs — Given Rise and Run

You need to build a stairway with a floor-to-floor height of 10 feet 1 inch, a run of 15 feet 5 inches, and a nominal desired riser height of 7-1/2 inches (default). Find all stair values.

Keystroke	Display
1. Enter rise and run:	
[On/C] [On/C]	0.
10 [Feet] 1 [Inch] [Rise]	RISE 10 FEET 1 INCH
15 [Feet] 5 [Inch] [Run]	RUN 15 FEET 5 INCH
2. Recall stored 7-1/2 inches desired riser height:	
[Rcl] [Stair]	R-HT 7-1/2 INCH
3. Find stair values:	
[Stair]	R-SZ 7-9/16 INCH
[Stair]	RSRS 16.
[Stair]	R+/- 0 INCH
[Stair]	T-WD 12-5/16 INCH
[Stair]	TRDS 15.
[Stair]	T+/- - 0-5/16 INCH
[Stair]	STRG 18 FEET 0-3/4 INCH
[Stair]	INC° 31.56°

Stair Risers Only — Custom Height

You're building an access stairway for a client who can't handle conventional-height stairs. If the total rise is 3 feet 9 inches and your desired riser height is approximately 5-1/2 inches, find the actual riser height, number of risers and underage or overage remaining.

<u>Keystroke</u>	<u>Display</u>
-------------------------	-----------------------

1. *Enter rise and riser height:*

[On/C] [On/C]	0.
3 [Feet] 9 [Inch] [Rise]	RISE 3 FEET 9 INCH
5 [Inch] 1[/] 2 [Stor] [Stair]	R-HT 5-1/2 INCH

2. *Find stair values:*

[Stair]	R-SZ 5-5/8 INCH
[Stair]	RSRS 8.
[Stair]	R+/- 0 INCH

3. *Return riser height setting to default:*

7 [Inch] 1[/] 2 [Stor] [Stair]	R-HT 7-1/2 INCH
----------------------------------	-----------------

Baluster Spacing

You are going to install a handrail at the top of a balcony. Your total span is 156 inches and you would like the space between the balusters to be about 4 inches. If each baluster is 1-1/2 inches wide, what is the exact spacing between each baluster?

<u>Keystroke</u>	<u>Display</u>
------------------	----------------

1. Estimate number of balusters in span.

[On/C] [On/C]	0.
156 [Inch] [-]	156 INCH
5 [Inch] 1 [/] 2 [=]*	28.36364 (28 balusters)
*desired spacing plus baluster width (4" plus 1-1/2").	

2. Find total space 'occupied' by the balusters by multiplying the width of each baluster by the rounded number of balusters (found above):

1 [Inch] 1 [/] 2 [x]	1-1/2 INCH
28 [=]	42 INCH

3. Find total space between all balusters:

156 [Inch] [-]	156 INCH
42 [Inch] [=]	114 INCH

4. Find actual baluster spacing by dividing total space between all balusters by the number of spaces between the balusters (number of balusters plus one equals 29):

114 [Inch] [-]	114 INCH
29 [=]	3-15/16 INCH

NUMBER OF STUDS

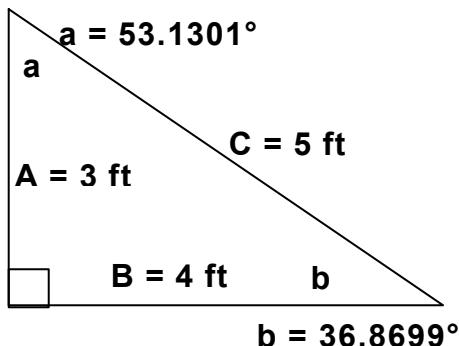
Find the number of 16-inch on-center studs needed for a wall with a length of 18 feet 7-1/2 inches.

<u>Keystroke</u>	<u>Display</u>
1. Divide length by spacing:	
[On/C][On/C]	0.
18 [Feet] 7 [Inch] 1 [/] 2	18 FEET 7-1/2 INCH
[÷] 16 [Inch] [=]	13.96875 (14 studs)
2. Add one for the end:	
[+] 1 [=]	14.96875 (15 studs)

TRIGONOMETRY AND D:M:S EXAMPLES

PRACTICAL TRIGONOMETRIC FORMULAS

The drawing and formulas below illustrate practical trigonometric applications:



Given side A and angle a, find:

Side C	$A \div a [\text{Cos}] [=]$
(i.e., $3 \text{ [Feet]} \div 53.13 \text{ [Cos]} [=]$)	
Side B	$A \times a [\text{Tan}] [=]$
Angle b	$90^\circ - a [=]$

Given side A and angle b, find:

Side B	$A \div b [\text{Tan}] [=]$
Side C	$A \div b [\text{Sine}] [=]$
Angle a	$90^\circ - b [=]$

Given side B and angle a, find:

Side A	$B \div a [\text{Tan}] [=]$
Side C	$B \div a [\text{Sine}] [=]$

Given side C and angle a, find:

Side A	$C \times a [\text{Cos}] [=]$
Side B	$C \times a [\text{Sine}] [=]$

Given side A and side C, find:

Angle a	$A \div C [=] \text{ [Conv] [Cos]}$
Angle b	$A \div C [=] \text{ [Conv] [Sine]}$

Converting Degrees:Minutes:Seconds

Convert $23^{\circ}42'39''$ to decimal degrees:

<u>Keystroke</u>	<u>Display</u>
[On/C] [On/C]	0.
23 [•] 42 [•] 39	DMS $23.42.39^{\circ}$
[Conv] [•] (d:m:s)	DEG 23.71083°

Convert 44.29° to degrees:minutes:seconds format:

<u>Keystroke</u>	<u>Display</u>
[On/C] [On/C]	0.
44.29 [Conv] [•] (d:m:s)	DMS $44.17.24^{\circ}$

Note: Improperly formatted entries will be redisplayed in the correct convention after any operator key is pressed. For example, $30^{\circ}89'$ entered will be corrected and displayed at $31^{\circ}29' 0''$ or 31.48333° .

Time Calculations Using D:M:S

Add 7 hours 45 minutes 33 seconds to 11 hours 16 minutes 20 seconds:

<u>Keystroke</u>	<u>Display</u>
[On/C] [On/C]	0.
7 [•] 45 [•] 33	DMS 7.45.33°
[+] 11 [•] 16 [•] 20 [=]	DMS 19.01.53°

Percent Grade/Slope

You are grading a piece of property and the site plans call for an embankment with a grade "no steeper than 35%." Your level shows the slope at an $18^{\circ}15'$ angle. Will this pass?

<u>Keystroke</u>	<u>Display</u>
------------------	----------------

Enter grade and convert to degrees:minutes:seconds:

Calculators with trigonometric functions:

[On/C] [On/C]	0.
35 [%] [Conv] [Tan] [Conv] [•]*	DMS 19.17.24°

*Note: Your calculator may already show the answer in decimal degrees prior to pressing [Conv]. Simply press [Conv] [-] to toggle between desired decimal degree or d:m:s formats.

Calculators without trigonometric functions:

[On/C] [On/C]	0.
35 [%] [Pitch]	PTCH 0.35
[Pitch]	PTCH 19.29°
[Conv] [•]	DMS 19.17.24°

Since your level reading of $18^{\circ}15'$ is less steep than $19^{\circ}17'24"$, the slope will pass inspection.

Converting Tangent/Pitch to Angle

Find the angle and corresponding tangent for a roof with an 8/12 pitch.

<u>Keystroke</u>	<u>Display</u>
1. Enter pitch:	
[On/C] [On/C] 8 [Inch] [Pitch]	0. PTCH 8 INCH
2. Convert pitch to degrees:	
[Pitch]	33.69°
3. Find tangent:*	
[Tan]	0.666667

**For LT, Handheld and Desktop: Press [Conv] [Pitch] to obtain same result.*

Converting Roof Angle to Pitch

Find the pitch of a roof with an angle of 30.25°.

<u>Keystroke</u>	<u>Display</u>
1. Enter angle:*	
[On/C] [On/C] 30.25 [Tan]	0. 0.583183
2. Convert to pitch:	
[Conv] [Pitch] [Pitch]	PTCH 0.583183 PTCH 7 INCH

**For a quicker solution for all Pro models: Press 30.25 [Pitch] [Pitch] to obtain the answer.*

Angle — Rise and Hypotenuse Known (Trig Plus III and Desktop Only)

Find the angle that connects the rise and hypotenuse of a right triangle, if the rise is 6 feet and the hypotenuse is 10 feet in length.

<u>Keystroke</u>	<u>Display</u>
-------------------------	-----------------------

1. Use trigonometric formula (divide rise(A) by hypotenuse(C)):

[On/C] [On/C]	0.
6 [Feet] [÷] 10 [Feet] [=]	0.6

2. Solve for degrees:minutes:seconds or angle:

[Conv] [Cos]	DEG 53.1301°
[Conv] [•]	DMS 53.07.48°

APPENDIX A — DEFAULT SETTINGS

After a Full Reset/All Clear, your calculator will return to the following settings:

<u>Setting</u>	<u>Imperial</u>	<u>Metric</u>
Area Display	Standard	n/a
Exponent	Off	Off
<i>(On for Trig Plus III) (On for Trig Plus III)</i>		
Desired Riser Height	7-1/2 inch	185 mm
Desired Tread Width	10 inch	250 mm
Fractional Preference	Standard	Standard
Fractional Resolution	1/16	1/16
<i>(1/64 for Trig Plus III) (1/64 for Trig Plus III)</i>		
Jack Rafters	Descending	Descending
On Center	16 Inch	600 mm
Meter Linear Display	0.000	0.000
Rake Wall	Descending	Descending
Reg./Irreg. Jack Spacing	OC-OC	OC-OC
Weight per Volume	1.5 Tons/Yd ³	1775 kg/M ³
Volume Display	Standard	n/a

Metric Mode

If you work in Metric vs. Imperial measurements, you can set your calculator to “Metric Mode,” where settings or answers are defaulted to the above metric values. To set the calculator to Metric Mode, **press the digit [1] key while turning the calculator on**. To return to Imperial Mode, repeat this procedure.

 **Note:** Removing the battery or a dead battery will cause the calculator to revert to the default of Imperial Mode.

APPENDIX B — PREFERENCE SETTINGS

The *Construction Master Pro* calculators have Preference Settings that allow you to customize or set desired dimensional formats and calculations. The options vary per model.

Note: * = Default Setting or the setting calculator defaults to upon performing an All Clear [Conv] [x].

Preference	Options
1) Fractional Resolution	<ul style="list-style-type: none">- *1/16 (displays fractional values to the nearest 16th of an inch)- 1/64 (*Default for Trig Plus III)- 1/32- 1/64- 1/2- 1/4- 1/8
2) Area Display Format (n/a for Metric Mode)	<ul style="list-style-type: none">- Standard (if units entered are the same—e.g., feet x feet—the answer will remain in this format (sq. ft), but if units entered are different—e.g., inches x feet—area answer will be displayed in square feet)- Square Feet (area answers always displayed in sq. ft, regardless of unit entry—e.g., inches x inches = sq. ft)- Square Yards (area answers always displayed in sq. yards—e.g., feet x feet = sq. yds)- Square Meters (area answers always displayed in sq. meters—e.g., feet x feet = sq. meters)

(Cont'd)

Note: To check the current Fractional Resolution, press [Rcl] [1]. Either "Std" (standard fractional resolution) or "Cnst" (constant) will be displayed, along with the fractional resolution.

(Cont'd)

Preference	Options
3) Volume Display Format (n/a for Metric Mode)	<ul style="list-style-type: none">- *Standard (if units entered are the same—e.g., ft x ft x ft—the answer will remain in this format (cu. ft), but if units entered are different—e.g., feet x feet x inches—vol. answer will always be displayed in cubic yards)- Cubic Yards (vol. answers always displayed in cu. yards, regardless of unit entry—e.g., feet x feet x feet = cu. yds)- Cubic Feet (vol. answers always displayed in cu. feet, regardless of unit entry—e.g., inches x inches x inches = cu. ft)- Cubic Meters (vol. answers always displayed in cu. meters, regardless of unit entry—e.g., feet x feet x feet = cu. meters)
4) Rake Wall Descending or Ascending	<ul style="list-style-type: none">- *Descending (Rake Wall studs are displayed from largest to smallest size)- Ascending (Rake Wall studs are displayed from smallest to largest size)
5) Jack Rafters Descending or Ascending (n/a for LT model)	<ul style="list-style-type: none">- *Descending (Jack rafters are displayed from largest to smallest size)- Ascending (Jack rafters are displayed from smallest to largest size)
6) Jack Rafters O-C or Mate (n/a for LT model)	<ul style="list-style-type: none">- *OC-OC (on-center spacing maintained on both regular and irregular sides)- JAC-JAC (regular/irregular Jack rafters “mate” at the hip/valley, i.e., on-center spacing not maintained on both sides)
7) Fraction Standard or Constant	<ul style="list-style-type: none">- *Standard (standard fractional resolution)- Constant (fractions are always based on user-set fractional resolution; default 16ths)

(Cont'd)

(Cont'd)

Preference	Options
8) Exponent Off or On	<ul style="list-style-type: none">- *Off (Exponential Mode is Off, turns on Auto-ranging; i.e., if display can't show seven digits, will display in next largest unit).- On (Exponential Mode is On - *Default for Trig Plus III)
9) Meter Linear Display	<ul style="list-style-type: none">- *0.000 (linear meter answers always displayed to third decimal place)- 0. (linear meter answers displayed to the maximum number of decimal points, as entered—e.g., 1.234 M + 2.56 M=3.794 M)

How to Set Preferences

The following sections detail Preference Setting options for the *Construction Master Pro* calculators.

Enter the Preference Mode by pressing **[Conv] [Stor] (Prefs)**. Access each category by pressing the **[Stor]** key until you reach the desired setting. *Within each category*, press the **[+]** or **[-]** keys to toggle between individual selections. Press **[On/C]** to exit and set in your Preference.

 **Note:** *[+]* will advance, *[-]* will back up. Pressing the **[Stor]** key continuously in this mode will revolve the Preference Settings full circle.

You may change these settings at any time by repeating the above, and setting in a new preference. Or, you may review settings by pressing **[Rcl] [Stor]**.

To clear preferences, press **[Conv] [x]**.

For example, if you wish to display all your dimensional area answers in square meters, press **[Conv] [Stor] [Stor] (Area Std)**, then the **[+]** key until “Area 0. SQ. M” is displayed. Simply exit this mode by pressing **[On/C]** or any key, *and all your future area answers will be displayed in square meters.*

(See the following pages for Preference Settings per model)

LT (#4030)

To Set “Fractional Resolution”:

[Conv] [Stor] (Prefs) (1st press of [Stor])	FRAC 0-1/16 INCH
[+] (plus sign)	FRAC 0-1/32 INCH
[+]	FRAC 0-1/64 INCH
[+]	FRAC 0-1/2 INCH
[+]	FRAC 0-1/4 INCH
[+]	FRAC 0-1/8 INCH

To Set Rake Wall Stud Sizes to “Descending” or “Ascending”:

[Stor] (2nd press of [Stor])	RAKE dESCEnd
[+] (plus sign)	RAKE ASCEnd

To Set “Area” Answer Format:

[Stor] (3rd press of [Stor])	AREA Std.
[+] (plus sign)	AREA 0. SQ FEET
[+]	AREA 0. SQ YD
[+]	AREA 0. SQ M

To Set “Volume” Answer Format:

[Stor] (4th press of [Stor])	VOL Std.
[+] (plus sign)	VOL 0. CU YD
[+]	VOL 0. CU FEET
[+]	VOL 0. CU M

To Set Fraction Resolution to “Standard” or “Constant”:

[Stor] (5th press of [Stor])	FRAC Std.
[+] (plus sign)	FRAC ConSt

To Set “Exponential Mode” On or Off:

[Stor] (6th press of [Stor])	EXP OFF
[+] (plus sign)	EXP On

To Set “Meter” Linear Decimal Format:

[Stor] (7th press of [Stor])	METR 0.000 M
[+] (plus sign)	METR 0. M

Note: Press [On/C] at any time to exit the Preference Mode.

Handheld (#4060) and Desktop (#44060)

To Set “Fractional Resolution”:

[Conv] [Stor] (Prefs) (1st press of [Stor])	FRAC 0-1/16 INCH
[+] (plus sign)	FRAC 0-1/32 INCH
[+]	FRAC 0-1/64 INCH
[+]	FRAC 0-1/2 INCH
[+]	FRAC 0-1/4 INCH
[+]	FRAC 0-1/8 INCH

To Set “Area” Answer Format:

[Stor] (2nd press of [Stor])	AREA Std.
[+] (plus sign)	AREA 0. SQ FEET
[+]	AREA 0. SQ YD
[+]	AREA 0. SQ M

To Set “Volume” Answer Format:

[Stor] (3rd press of [Stor])	VOL Std.
[+] (plus sign)	VOL 0. CU YD
[+]	VOL 0. CU FEET
[+]	VOL 0. CU M

To Set Rake Wall Stud Sizes to “Descending” or “Ascending”:

[Stor] (4th press of [Stor])	RAKE dESCEnd
[+] (plus sign)	RAKE ASCEnd

To Set Jack Rafter to “Descending” or “Ascending”:

[Stor] (5th press of [Stor])	JACK dESCEnd
[+] (plus sign)	JACK ASCEnd

To Set Regular/Irregular “Jack Spacing”:

[Stor] (6th press of [Stor])	IRJK OC-OC
[+] (plus sign)	IRJK JAC-JAC

To Set Fraction Resolution to “Standard” or “Constant”:

[Stor] (7th press of [Stor])	FRAC Std.
[+] (plus sign)	FRAC COnSt

To Set “Exponential Mode” On or Off:

[Stor] (8th press of [Stor])	EXP OFF
[+] (plus sign)	EXP On
	(Cont'd)

(Cont'd)

To Set “Meter” Linear Decimal Format:

[Stor] (9th press of [Stor])

[+] (plus sign)

METR 0.000 M

METR 0. M

Note: Press **[On/C]** at any time to exit the Preference Mode.

Trig Plus III (#4075)

To Set “Fractional Resolution”:

[Conv] [Stor] (Prefs) (1st press of [Stor])	FRAC 0-1/64 INCH
[+] (plus sign)	FRAC 0-1/2 INCH
[+]	FRAC 0-1/4 INCH
[+]	FRAC 0-1/8 INCH
[+]	FRAC 0-1/16 INCH
[+]	FRAC 0-1/32 INCH

To Set “Area” Answer Format:

[Stor] (2nd press of [Stor])	AREA Std.
[+] (plus sign)	AREA 0. SQ FEET
[+]	AREA 0. SQ YD
[+]	AREA 0. SQ M

To Set “Volume” Answer Format:

[Stor] (3rd press of [Stor])	VOL Std.
[+] (plus sign)	VOL 0. CU YD
[+]	VOL 0. CU FEET
[+]	VOL 0. CU M

To Set Rake Wall Stud Sizes to “Descending” or “Ascending”:

[Stor] (4th press of [Stor])	RAKE dESCEnd
[+] (plus sign)	RAKE ASCEnd

To Set Jack Rafter to “Descending” or “Ascending”:

[Stor] (5th press of [Stor])	JACK dESCEnd
[+] (plus sign)	JACK ASCEnd

To Set Regular/Irregular “Jack Spacing”:

[Stor] (6th press of [Stor])	IRJK OC-OC
[+] (plus sign)	IRJK JAC-JAC

To Set Fraction Resolution to “Standard” or “Constant”:

[Stor] (7th press of [Stor])	FRAC Std.
[+] (plus sign)	FRAC ConSt
(Cont'd)	

(Cont'd)

To Set “Exponential Mode” On or Off:

[Stor] (8th press of [Stor])
[+] (plus sign)

EXP On
EXP OFF

To Set “Meter” Linear Decimal Format:

[Stor] (9th press of [Stor])
[+] (plus sign)

METR 0.000 M
METR 0. M

 **Note:** Press [On/C] at any time to exit the Preference Mode.

APPENDIX C — USING THE DESKTOP PRINTING MODEL (DT Printer: #44065)

TABLE OF CONTENTS:

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Replacing the Paper Roll	110
Replacing the Ink Roller.....	112
Notes on Using the Printer.....	114

NOTE: You must own model #44065 (*Construction Master Pro DT Printer*) to use a printer. Model #44065 is almost identical (function-wise) to the *Construction Master Pro DT/Desktop* (#44060), except it includes a built-in printer with a paper printout and has special Auto-Print features.

Your Construction Master Pro DT Printer calculator comes with a printer that you can switch on or off. See the instructions below.

PRINTER KEYS

[Off—On—Print] — Power Switch

Switch that turns the printer and calculator on and off. This power switch is located in the upper left.

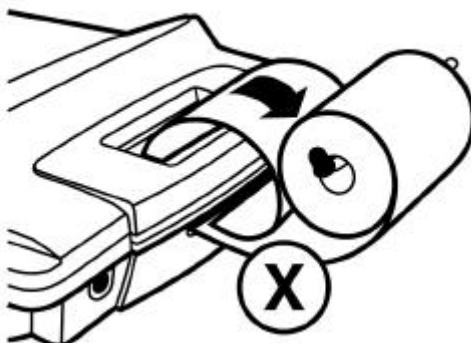
- “Off” - Power Off: *move switch to far left.*
- “On” - Power On, Printer Off: *move switch to middle position.*
- “Print” - Print Mode (Calculator and Printer On): *move switch to far right.*

[▲] — **Paper Feed**

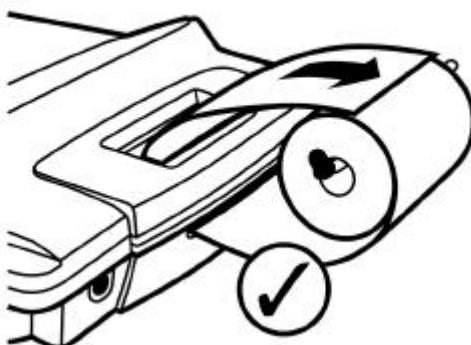
Press this key to advance the printer paper.

Note of Caution: When your printing paper is running low (you are nearing the end of the roll), the paper may curl back into the feeder and jam (see “**A**”). The proper feed is shown below (see “**B**”). It is therefore best to replace the paper before this can occur. (See “*Replacing the Paper Roll*”).

A



B



[Rcl] [=] — Print Display

Prints the value currently on the calculator's display.

[Conv] [=] — Print List

Prints the entire list of values in a repetitive-solution problem (e.g., Stairs, Jacks, Circle), after variables are entered and the respective solution key (e.g., **[Stair]** key) is pressed.

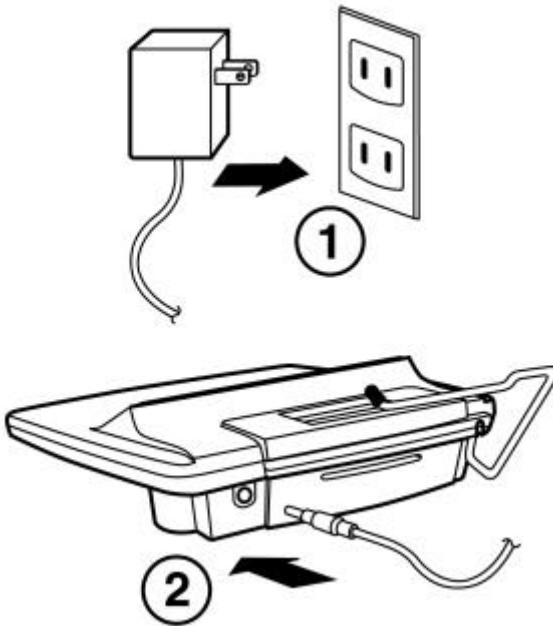
[Conv] [x] [x] — All-Clear/Full Reset

Clears/resets the calculator back to its default settings. Use this only with caution, as it will erase any custom Preference settings you have programmed.

CONNECTING THE AC ADAPTER

Your calculator operates on AC power so you don't have to use batteries. To connect the AC adapter, first make sure your calculator is turned off (power switch to "Off"). Then, plug the AC power plug into a power outlet (**Step 1**) and plug the connecting end into the small outlet at the end base of your calculator (**Step 2**), as shown.

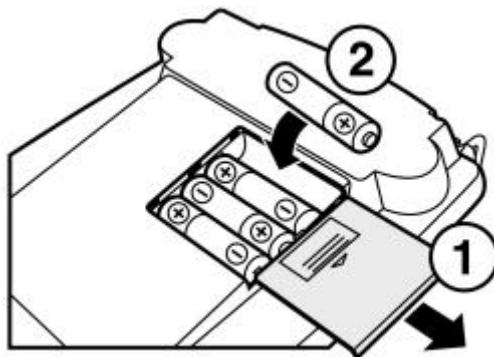
If you do not want to use AC power but prefer to run the unit on battery power instead, you must purchase and install batteries. (See next page "**Using Battery Power**").



USING BATTERY POWER

As your *Construction Master Pro DT Printer* works on AC power, it does not come with batteries. You can purchase AA batteries at your local RadioShack, or any store that sells batteries.

- **Batteries:** Four AA batteries
 1. Switch power to “Off.”
 2. Turn calculator over and remove the battery cover by sliding it in the direction of the arrow. **See (1) on figure below.**
 3. Insert 4 AA batteries, making sure the “-” and “+” on the calculator match the “-” and “+” on each battery. **See (2) below.**
 4. Slide on the battery cover.

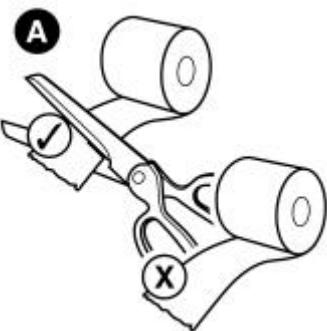


REPLACING THE PAPER ROLL

You can find replacement printer paper for calculators at your local Staples, Office Depot, or other office supply store:

- **Paper Type:** Width: 57mm (2-1/4"); Diameter: 86mm (3-3/8") or less.

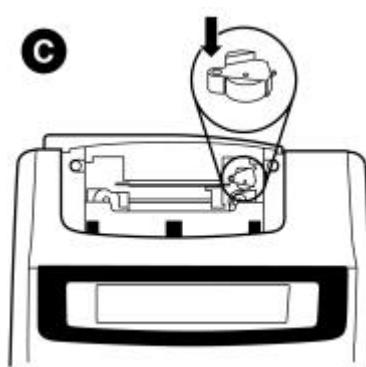
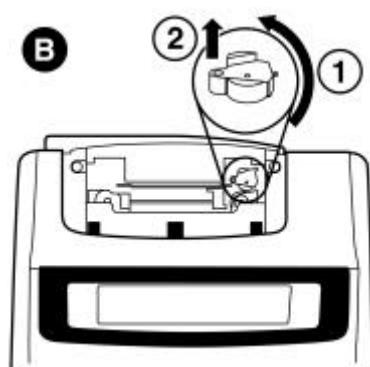
1. Cut leading edge of paper roll first, prior to inserting (as torn paper will jam). **See (A) on next page.**
2. Insert the leading edge of the paper roll into the slit located on the back of the calculator. **See (B) on next page.**
3. Turn the power on (switch to Print Mode or "Print").
4. Feed the paper through the slot by pressing the paper feed [] key. **See (C) on next page.**
5. Place the new paper roll on the arm. **See (D) on next page.**



REPLACING THE INK ROLLER

You can purchase a replacement ink roller from CI at www.calculated.com or by calling 1-800-854-8075. (CI product number 5002-IR1)

1. Move the power switch to “Off.”
2. Remove the plastic print cover. **See (A) on next page.**
3. Remove the ink roller (small black ink roller located to the right of the paper). **See (B), Step 1 on next page.** Push the top lever on the ink roller back using your thumb nail; then remove the roller by pulling the lever up and out using your thumb & forefinger (snap & release). **See (B), Step 2 on next page.**
4. Insert a new ink roller into position. **See (C) on next page.**
5. Replace the plastic print cover.



NOTES ON USING THE PRINTER

Auto-Printing Answers

A unique feature of your *Construction Master Pro DT Printer* is that it will automatically print repetitive-solution problems when it is in Printing Mode (power switch must be set to "Print"). In other words, it will automatically print all the answers in **[Stair]**, **[Jack]**, **[Rake Wall]** and **[Circ]** problems upon a single press of the respective key. This saves keystrokes, or repetitive key pressing.

For example, to automatically print all **[Stair]** values once the problem has been "set up" (variables have been entered), simply press the **[Stair]** key. All the stair riser/tread variables/inputs and answers will print upon a single press of the **[Stair]** key.

Setting Your Calculator to Auto-Print

You must have your calculator set to "Print," or switched to Printing Mode (using the power switch), in order to use auto-printing. The Preference Setting must also be set to "Print List On." (*Default is "Off"*). See below:

To Access "Print List On"/Auto-Print Preference Setting:

Press **[Conv]** **[Stor]** to access the Preference Mode. Then press the **[Stor]** key until "Print List Off" is displayed (display reads "**LIST Off**"); this is the default setting. To turn Auto-Printing on, press the **[+]** key once to advance the display to read "**LIST On**". Store this preference by pressing **[CE/C]**.

Print List Command

As a faster method to Auto-Print/Preference Setting, you can automatically print values in repetitive-solution problems (e.g. Stairs) by pressing **[Conv] [=]**.

Note: You do not have to access the Preference Setting or even be in Print Mode to use this setting; the calculator will automatically print regardless of whether your calculator is set to Print or On.

[Conv] [=] — Print List

Prints the entire list of values in a repetitive-solution problem (e.g., Stairs, Jacks, Circle), after variables are entered and the respective solution key (e.g., **[Stair]** key) is pressed.

No Paperless Tape

As this model has a printer, it does not contain the “Paperless Tape” feature regularly found on the non-printing *Construction Master Pro* calculators (i.e., there is no need for a paperless tape when a printer is available).

Annunciators

Some annunciators will print differently than those viewed on the calculator display while in non-printing mode, or on the display of the non-printing *Construction Master Pro* desktop and other *Construction Master Pro* models. See the table below for a list of these annunciator differences:

Construction Master Pro DT (#44060)	Construction Master Pro DT Printer (#44065)
Annunciators	Annunciators (printed on tape as)
FEET INCH	' "
FEET (decimal only)	FT
INCH (decimal only)	IN
SQ INCH	SI
SQ FEET	SF
SQ YD	SY
SQ M	SM
SQ CM	SCM
SQ MM	SMM
CU INCH	CI
CU FEET	CF
CU YD	CY
CU M	CBM
CU CM	CCM
CU MM	CMM
kG	KG
Ton	TN
MET Ton	MTN
B_AR	B-AR
B FEET	BF
\$ Per	COST
° (Degree symbol)	DG
INC°	INC

APPENDIX D — IMPORTANT NOTES FOR OWNERS OF PREVIOUS CONSTRUCTION MASTERS®

If you are an owner of a previous *Construction Master* calculator, the following list will help you compare several new or enhanced features available on selected *Construction Master Pro* calculators.

New/Enhanced Function	Description
New Block/Brick, Column, Footing and Roof Keys	<ul style="list-style-type: none">– New construction project keys have been added for quickly figuring quantities and costs of materials.
Circle	<ul style="list-style-type: none">– You may now calculate additional circle properties, including: radius from a circular segment height and base, degree of arc, chord length, segment rise, pie slice area and segment area.
Jack Rafters/Irregular Jack Rafters	<ul style="list-style-type: none">– The value stored in the on-center register – [Stor] [7] – is used for both Jacks (parallel to the Common) and Irregular Jacks (perpendicular to the Common).– Based on your Preference setting, Jacks/Irregular Jacks can be calculated in descending (default) or ascending order.– Based on your Preference setting, Irregular Jacks can be calculated based on stored on-center spacing or spaced to mate with opposing Jacks.
Memories	<ul style="list-style-type: none">– The Pro calculators have three separate memories: (1) a semi-permanent, accumulating memory in [M+]; (2) two permanent single-value memories in digits 1 and 2, accessed using the [Stor] key and the corresponding digit key.
On-Center Spacing	<ul style="list-style-type: none">– A single register – [Stor] [7] – is used to establish all on-center values; used for Jacks, Irreg. Jacks and Rake Wall Studs.

(Cont'd)

(Cont'd)

New/Enhanced Function	Description
Preference Settings	<ul style="list-style-type: none">Dimensional formats for calculated areas and volumes may be set to display in preferred formats (e.g., sq. feet, cu. yards). Also, Jack rafters and Rake Wall stud sizes may be set to display in either ascending or descending order. (See <i>Preference Settings</i> on page 96.)
Rake Wall	<ul style="list-style-type: none">Rake Wall is a second function of the [Rise] key.The value stored in the on-center register – [Stor] [7] – is used for the on-center spacing for Rake-Wall studs.You may now input a base height from which all Rake Wall studs will be calculated – e.g., [5] [Feet] [Conv] [Rise] will calculate Rake Wall studs from a base of 5 feet rather than zero.Based on your Preference setting, Rake Walls can be calculated in descending (default) or ascending order.
Rafter Cutting Angles	<ul style="list-style-type: none">You may now calculate Rafter Cutting Angles: Diagonal Plumb, Level and Hip/Valley/Jack Plumb, Level, Cheek.
Stairs	<ul style="list-style-type: none">Desired value for Riser Height is stored via [Stor] [Stair]. (Default value is 7-1/2 inches.)You may now store a desired Tread Width value via [Stor] [M]. (Default is 10 inches.) This allows you to enter only a floor-to-floor rise or only a total run and still calculate an entire stairway.
Weights	<ul style="list-style-type: none">Weight per volume is now permanently stored using [Stor] [8].Units available in Pounds (lbs.), Tons, Kilograms (kg) and Metric Tons.

APPENDIX E — ACCURACY, AUTO SHUT-OFF, BATTERIES, ERRORS

Accuracy/Errors

Accuracy/Display Capacity — Your calculator has an eleven-digit display made up of seven digits (normal display) and four fractional digits. Each calculation is carried out internally to ten digits.

Errors — When an incorrect entry is made, or the answer is beyond the range of the calculator, it will display the word “**ERROR**.” To clear an error condition you must hit the **[On/C]** button once. At this point you must determine what caused the error and re-key the problem.

Error Codes:

<u>Display</u>	<u>Error Type</u>
0-fL0	Overflow (too large)
Error 1	As above, but for exponents (value $> 1e74$)
Error 2	Divide by 0
Error 3	Dimension error
Error 4	Entry error
Error 5	Type error
Error 6	Trig. error (for example, tan of 1 foot)
Error 7	Does not occur (tape error)
None	Attempt to calculate stairs without entering rise or run

Auto-Range — If an “overflow” is created because of an input and calculation with small units that are out of the standard seven-digit range of the display, the answer will be automatically expressed in the next larger units (instead of showing “**ERROR**”) — e.g., 10,000,000 mm is shown as 10,000 m. Also applies to inches, feet and yards.

Note: If Exponential Notation is activated through the Preference Setting, the value will be shown in scientific notation (e.g., 10 million mm— 1.0000^{07} mm).

Auto Shut-Off

Your calculator is designed to shut itself off after about 8-12 minutes of non-use.

Battery(ies)

- **Construction Master Pro DT (Desktop) Model (#44060)** — One 3-Volt Lithium CR-2032 battery.
- **DT Printer (#44065)** — Four AA batteries.
- **Pro Handhelds (#4030/#4060/#4075)** — Two LR44 batteries.

Replacing the Battery(ies)

Should your calculator display become very dim or erratic, replace the battery(ies).

 **Note:** Please use caution when disposing of your old battery, as it contains hazardous chemicals.

Replacement batteries are available at most discount or electronics stores. You may also call Calculated Industries at 1-775-885-4975.

Battery Replacement Instructions

- **Construction Master Pro DT (Desktop) Model (#44060):**

To replace the battery, use a small Phillips' head screwdriver and unscrew the two (2) screws on the base of the unit. Carefully remove the lower back housing. Remove the battery from the clip and replace it with a new battery, with the positive side up. Then replace the backplate and reattach the screws.

- **Construction Master Pro DT Printer Model (#44065):**

See **Appendix C** for instructions.

- ***The Handheld Models —***
 - ***Construction Master Pro LT (#4030)***
 - ***Construction Master Pro (#4060)***
 - ***Construction Master Pro Trig Plus III (#4075)***

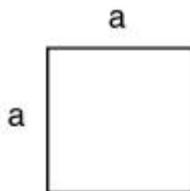
To replace the batteries, slide open the battery door (at top backside of unit) and replace with new batteries. Make sure the batteries are facing positive side up.

Reset Key

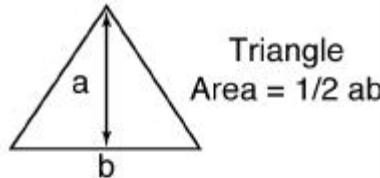
If your calculator should ever “lock up,” press Reset—a small hole located to the left (*or right for the Construction Master Pro Desktop or Desktop Printer*) of the **[Off]** key—to perform a total reset.

APPENDIX F — AREA/VOLUME FORMULAS

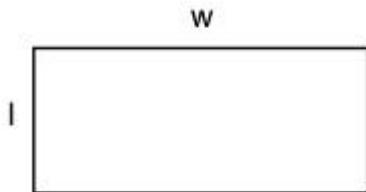
Area Formulas



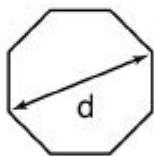
Square
Area = a^2



Triangle
Area = $1/2 ab$



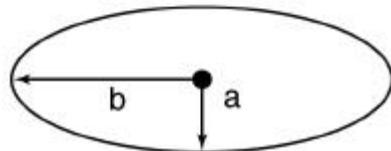
Rectangle
Area = lw



Octagon
 $(d/2)^2 \times 2.828 = \text{Area}$

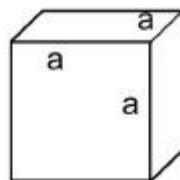


Circle
Circumference = $2\pi r$
Area = πr^2



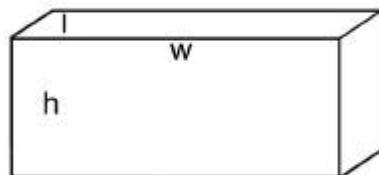
Ellipse
Area = πab

Surface Area/Volume Formulas



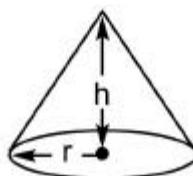
Cube

$$\text{Surface Area} = 6a^2$$
$$\text{Volume} = a^3$$



Rectangle

$$\text{Surface Area} =$$
$$2hw + 2hl + 2lw$$
$$\text{Volume} = l \times w \times h$$

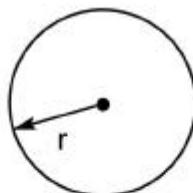


Cone

$$\text{Surface Area} = \pi r \sqrt{r^2 + h^2}$$

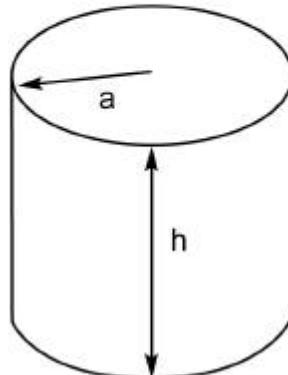
(+ πr^2 if you add the base)

$$\text{Volume} = \frac{\pi r^2 h}{3}$$



Sphere

$$\text{Surface Area} = 4\pi r^2$$
$$\text{Volume} = \frac{4}{3}\pi r^3$$



Cylinder

$$\text{Surface Area} = 2\pi rh + 2\pi r^2$$
$$\text{Volume} = \pi r^2 h$$

REPAIR AND RETURN

Warranty, Repair and Return Information

Return Guidelines:

1. Please read the **Warranty** in this User's Guide to determine if your Calculated Industries calculator, measuring device or electronic tool remains under warranty **before** calling or returning any device for evaluation or repairs.
2. If your calculator won't turn on, try pressing the "Reset Button" first. If it still won't turn on, check the batteries as outlined in the User's Guide.
3. **If there is a black spot on the LCD screen, THIS IS NOT A WARRANTY DEFECT. The unit can be repaired. Call for a repair quote before returning your unit.**
4. If you need more assistance, please go to our website at www.calculated.com and click on Product Support, then Repair Services FAQs.
5. If you believe you need to return your calculator, please speak to a Calculated Industries representative for additional information!

Call Toll Free: 1-800-854-8075

WARRANTY

Warranty Repair Service – U.S.A.

Calculated Industries ("CI") warrants this product against defects in materials and workmanship for a period of one (1) year from the date of original consumer purchase in the U.S. If a defect exists during the warranty period, CI at its option will either repair (using new or remanufactured parts) or replace (with a new or remanufactured calculator) the product at no charge.

THE WARRANTY WILL NOT APPLY TO THE PRODUCT IF IT HAS BEEN DAMAGED BY MISUSE, ALTERATION, ACCIDENT, IMPROPER HANDLING OR OPERATION, OR IF UNAUTHORIZED REPAIRS ARE ATTEMPTED OR MADE. SOME EXAMPLES OF DAMAGES NOT COVERED BY WARRANTY INCLUDE, BUT ARE NOT LIMITED TO, BATTERY LEAKAGE, BENDING, OR VISIBLE CRACKING OF THE LCD, WHICH ARE PRESUMED TO BE DAMAGES RESULTING FROM MISUSE OR ABUSE.

To obtain warranty service in the U.S., ship the product postage paid to Calculated Industries (address listed on page 126). Please provide an explanation of the service requirement, your name, address, day phone number and dated proof of purchase (typically a sales receipt). If the product is over 90 days old, include payment of \$6.95 for return shipping and handling within the contiguous 48 states. (Outside the contiguous 48 states, please call CI for return shipping costs.)

A repaired or replacement product assumes the remaining warranty of the original product or 90 days, whichever is longer.

Non-Warranty Repair Service – U.S.A.

Non-warranty repair covers service beyond the warranty period or service requested due to damage resulting from misuse or abuse.

Contact Calculated Industries (phone number listed page 126), to obtain current product repair information and charges. Repairs are guaranteed for 90 days.

Repair Service – Outside the U.S.A.

To obtain warranty or non-warranty repair service for goods purchased outside the U.S., contact the dealer through which you initially purchased the product. If you cannot reasonably have the product repaired in your area, you may contact CI to obtain current product repair information and charges, including freight and duties.

Disclaimer

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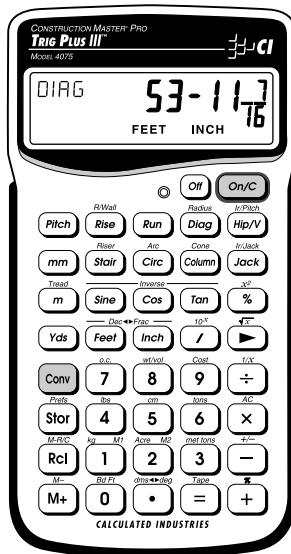
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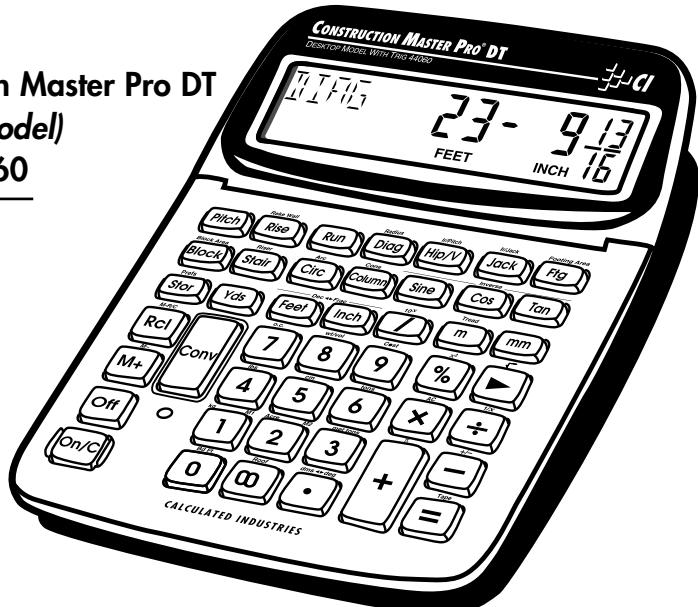


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